City of Boston
Town of Brookline

Phase 1 Muddy River Flood Control, Water Quality and Habitat Enhancement, and Historic Preservation Project

EOEA #11865

February 2003

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In Association with:

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Final Environmental Impact Report

Volume 1 – Main Report

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February 18, 2003

Ms. Ellen Roy Herzfelder
Secretary of Environmental Affairs
Attention: MEPA Office
Arthur Pugsley, EOEA No. 11865
251 Causeway Street, Suite 900
Boston, Massachusetts 02214

Subject: Final Environmental Impact Report; EOEA No. 11865
Phase 1 Muddy River Flood Control, Water Quality and Habitat Enhancement, and Historic Preservation Project

Dear Secretary Herzfelder:

On behalf of the City of Boston and the Town of Brookline, enclosed are three copies of the Final Environmental Impact Report (EIR) in compliance with MEPA regulations and the Certificates on the Environmental Notification Form (ENF) and Draft EIR issued on April 24, 1999 and April 16, 2002, respectively.

The Citizens Advisory Committee (CAC) established specifically for this project has been actively involved during preparation of the Final EIR. Furthermore, as required by Special Review Procedure for this project, this Final EIR was submitted to the CAC for review 30 days in advance of this formal submittal to MEPA. Comments received on the Draft EIR and the Draft EIR Certificate have been summarized and addressed in this Final EIR. Full copies of comment letters are provided in Appendix A.

Please publish notice of the availability of this Final EIR in the next issue of the Environmental Monitor. The proponents also request that the comment period be extended to 60 days, allowing the public greater opportunity to review the final EIR.

CDM

Ms. Ellen Roy Herzfelder
Secretary of Environmental Affairs
February 18, 2003
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To receive a copy of the Final EIR, please e-mail info@muddyriverproject.org, call Phil Kennedy of CDM at (617) 452-6560, or stop by the Boston Parks and Recreation Department or the Brookline Department of Public Works offices. Copies for public viewing are also available at various repositories in Boston and Brookline (see attached list).

Very truly yours,

Bruce R. Conklin

Bruce R. Conklin, P.E.
Vice President
Camp Dresser & McKee Inc.

Enclosures

cc: Margaret Dyson, BPRD
Thomas Brady, Town of Brookline
John Burkardt

CDM

Repository Copies

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Brookline Public Library
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Phase 1 Muddy River Project Flood Control, Water Quality and Habitat Enrichment, and Historic Preservation Project

EOEA File No. 11865

Final Environmental Impact Report

Proponents: Boston Parks and Recreation Department
Town of Brookline

Preparers: Camp Dresser & McKee Inc.
Jason M. Cortell and Associates Inc.
Pressley Associates, Inc.
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Green International Affiliates, Inc.

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Rehabilitation of the Emerald Necklace

The Emerald Necklace is the oldest remaining linear park system in the United States and the largest in Boston. Designed more than a century ago by renowned landscape architect Frederick Law Olmsted, six parks and related waterways stretch more than six miles from Dorchester to Back Bay and include both Boston and Brookline:

- Franklin Park (Scarboro Pond)
- Arnold Arboretum
- Jamaica Park (Jamaica Pond)
- Olmsted Park (Ward's, Willow, and Leverett Ponds)
- The Riverway
- The Back Bay Fens, which joins the Riverway via the Muddy River

In the century since the creation of Emerald Necklace, the land surrounding it has been subjected to increasing urbanization – resulting in a decline in the richness and diversity of Olmsted's distinctive landscape:

- Flooding has worsened because there is little natural storage left in the widely paved watershed, and sediment and debris have washed into the river constricting flood-carrying capacity;
- Water quality has deteriorated as an array of natural and man-made compounds are carried off the land surface during rainstorms and deposited into the river and accumulated in the sediment;
- Non-native invasive species of flora such as *Phragmites*, knotweed, and buckthorn have overtaken portions of the river, pushing out native species, creating safety hazards, eliminating natural habitats, and greatly limiting the diversity of wildlife that can live within the watershed.

The need for rehabilitation of the Emerald Necklace is apparent and was first addressed in 1989 in the Emerald Necklace Parks Master Plan (which was subsequently updated in 2001). The Master Plan recommended more than 52 improvements to rehabilitate and preserve the Emerald Necklace organized into four phases:

- Phase I: Dredging, flood control, water quality improvements, aquatic/riparian habitat enhancement, historic rehabilitation, and best management practices within the Muddy River area (the Back Bay Fens, Riverway, and Olmsted Park and its waterways).

- Phase II: Historic landscape improvements, revegetation, major traffic and pedestrian circulation improvements, major building and vehicular bridge restoration (also within the Muddy River area).
- Phase III: Minor traffic circulation improvements, small building and pedestrian bridge restoration (also within the Muddy River area).
- Phase IV: Park and water body improvements in the remaining areas of the Emerald Necklace (i.e., Jamaica Park, Arnold Arboretum, and Franklin Park/Scarboro Pond).

The current project, which is the subject of this document, is Phase I of the rehabilitation efforts, referred to as Phase I Muddy River Flood Control, Water Quality and Wildlife Enhancement and Historic Preservation Project.

Project Overview

The project described herein involves a multidisciplinary approach to improving the Muddy River system, adjacent parkland, and other areas that are part of what is referred to as the Emerald Necklace, located in Boston and Brookline, Massachusetts. Components of the project are derived from previous engineering and historical studies of the project area including the Emerald Necklace Master Plan, and flood control studies by the Army Corps of Engineers (ACOE), the Executive Office of Environmental Affairs (EOEA), and the Federal Emergency Management Agency (FEMA).

Stakeholders

Stakeholders with a common interest in restoring the Muddy River include: Boston Parks and Recreation Department (which serves as the lead agency), the Town of Brookline (which together with Boston is a project proponent), the Massachusetts Department of Environmental Management, the Metropolitan District Commission, and the Boston Water and Sewer Commission. Several other agencies and entities also have actively supported the project, including The Emerald Necklace Conservancy (ENC), the ACOE, EOEA, FEMA, Department of Federal Housing and Urban Development (HUD), and the Massachusetts Emergency Management Agency (MEMA). Many non-profit environmental groups, neighborhood groups and individual citizens have worked in cooperation on the project as well. A Citizens Advisory Committee, for example, was established to provide input to the project and has been active in reviewing and commenting on project submittals in advance of finalization.

Project Location

The project area, shown in Figure ES-1, is within the Muddy River watershed, defined as the area beginning with the Muddy River confluence with the Charles River, and extending 3.5 miles upstream to Ward's Pond and including:

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Figure ES-1
Site Location

- The Charlesgate area (Boylston Street to the Charles River);
- The Back Bay Fens (The Riverway at the former Sears Parking Lot to Boylston Street);
- The Riverway (The Riverway at the former Sears Parking Lot to Leverett Pond);
- Leverett Pond;
- Willow Pond; and
- Ward's Pond.

Improvements in the Charlesgate area were previously reviewed and approved by the regulatory authorities and construction in this area is underway. Therefore, this document focuses on the remaining Phase I work – from the Back Bay Fens extending upstream to Ward's Pond.

The Final Environmental Impact Report

This report is the Final Environmental Impact Report (EIR) for the Phase I project. The Final EIR responds to issues raised by the Secretary of Environmental Affairs and commenters on the Draft EIR, which was filed on January 31, 2002.

The Certificate on the Draft EIR, issued on April 16, 2002, stated that the Draft EIR provided enough information to demonstrate that the preferred alternative generally minimizes environmental impacts, and presents a generally complete description of the project, its alternatives, and its impacts. However, several important issues were noted as being unresolved. Specifically, the Secretary called for more detailed information on wetlands and water quality impacts; more information on alternatives; a more detailed, specific, and enforceable Maintenance and Management Plan; responses to the numerous comments on the Draft EIR; and responses to other issues outlined in the Certificate. The Secretary also noted that the Final EIR may incorporate by reference those portions of the Draft EIR that do not require further analysis.

Project Objectives

The project is designed to meet a number of objectives. Each objective is included to address specific problems that have developed over time and/or to maximize the benefits to be derived from the proposed improvements. The following summarizes the problems to be addressed.

Provide Flood Control. In October 1996, the Muddy River flooded as a result of a storm that deposited 5.45 inches of rain in a period of 24 hours, and incurred damages estimated at $63M for the Muddy River, the MBTA and Stony Brook Conduit. (Damage estimate provided by the US Corps of Engineers for public damages. FEMA reported alternative avoided damages between $74 and $117 million including public

and private damage.) Analyses conducted subsequently show that the 1996 storm flows overwhelmed the Muddy River capacity as a result of the increase in impervious area within the watershed over time, and constrictions in flow capacity caused by inadequate culvert sizes where the Muddy River has been culverted under the former Sears parking lot and at the Fens Bridge. The encroachment of invasive species and the deposition of sediment also have reduced the flood-carrying capacity in certain sections of the channel. The project will improve flood control by increasing culvert capacity and removing flow restrictions in the waterway.

Improve Water Quality. Urban runoff and storm drain discharges have resulted in sedimentation, increased turbidity, and other contaminants have been found in both the water column and in river sediments. A reduction in dissolved oxygen has also resulted. These discharges have contributed to the water quality degradation experienced along some portions of the Muddy River. Removing contaminated and organically enriched sediments, stabilizing banks where needed, and implementing other measures (such as over-dredging and instituting Best Management Practices, or BMPs), are intended to address the water quality problem in the Muddy River.

Enhance Aquatic and Riparian Habitat. Much of the sediment in the river is contaminated with compounds typically found in urban environments (e.g., metals). Removal will result in improved aquatic habitat. Reconstructing or replanting historic islands will also improve the aquatic and riparian habitat. In addition, the replanting plan for disturbed riparian areas entails providing a diverse habitat and where appropriate, replacing invasive species that have overtaken certain areas with a variety of plantings to provide improved wildlife habitat.

Institute Best Management Practices in the Muddy River System. Since 1898, portions of the Muddy River have been dredged approximately every thirty years as a result of cyclical sedimentation accumulation. The implementation of Best Management Practices (BMPs) is intended to maximize the life span of the improvements for the other project objectives, i.e., flood control, water quality, habitat enhancement, and historic resources. BMPs will be an integral component of the overall plan to protect the public's investment in this valuable resource.

Restore Landscape and Historic Resources. The distinctively designed landscape of the Emerald Necklace Parks has declined due to inattention and the vanishing of many species that were an integral part of the parks. Significant areas have been overtaken by invasive species, including *Phragmites,* Japanese Knotweed, and glossy buckthorn. The project will rehabilitate and preserve the historic landscape and historic resources.

Proposed Activities

Each of the improvements discussed in this report is associated with one or more of the following activities: dredging, infrastructure improvements, wetlands restoration/bank stabilization, historic landscape improvements, and/or Best Management Practices (BMPs).

Dredging and Infrastructure Improvements

Flood carrying capacity of the Muddy River will be improved and historic capacities of Leverett, Willow and Ward's Ponds will be restored via dredging and removal of accumulated sediment. Construction activities will include dredging via hydraulic dredge, proper management of dredged material, removal of invasive species (such as *Phragmites*), refilling of shoreline areas, and final regrading to historic shoreline configurations.

Proposed infrastructure improvements include culvert replacements/daylighting, and some improvements to roadway storm drain systems.

Wetlands Restoration/Bank Stabilization

Restoring a more diverse plant community along the banks of the river and ponds will involve alteration of the banks in areas to re-grade contours and remove existing vegetation that is inconsistent with the Olmsted plan. Once dredging is completed in each area, the banks will be replanted to create a diverse plant community along the shoreline. This will improve habitat capacity compared to existing conditions and serve to stabilize banks. In addition to restoration of existing degraded wetlands, replication or replacement wetlands will be established in selected upland areas.

The work in wetlands, including dredging, is proposed as a limited project, pursuant to the Wetlands Protection Act (310 CMR 10.53(4)), which allows projects to proceed that "will improve the natural capacity of a resource area(s) to protect the interests" of the Act.

Historic Landscape Improvements

Rehabilitation of Olmsted's historic park system will require a balance of engineering solutions and landscape design. The following actions are necessary, either individually or in combination:

- Remove invasive vegetation;
- Protect historic resources from damage due to construction;
- Preserve and rehabilitate the historic river bank configuration along the Muddy River, including rehabilitation of the historic islands; and
- Plant vegetation in keeping with the historic landscape design, guided by the Emerald Necklace Master Plan.

Best Management Practices

The project also includes watershed-wide BMPs. The goal of the BMP plan for the watershed is to reduce solids loading in the river by 30 percent by the year 2006. The proposed BMPs include source control BMPs -- street sweeping, construction site controls, catch basin cleaning, and cleaning and improvements to the Stony Brook

conduit. Proposed structural BMPs are composed primarily of particle separators but also include bioretention areas, sand filters, and swales.

Activities by Area

Specific activities comprising the project in each of the geographic areas (The Back Bay Fens area, The Riverway, Leverett Pond, Willow Pond, and Wards Pond) are outlined below:

- Back Bay Fens: daylighting culverts at the Fens Bridge and former Sears parking lot to restore the Olmsted-designed shoreline; bank-to-bank dredging to remove 95,500 cubic yards (cy) of sediment and debris, and 23,500 cy of *Phragmites*; installing new arch culverts under the Riverway and Brookline Avenue; improvements to roadway storm drain systems; and bank and landscape rehabilitation.

- The Riverway: bank-to-bank dredging to remove 21,200 cy of sediment and debris, and 10,000 cy of *Phragmites;* improvements to roadway storm drain systems; and bank and landscape rehabilitation.

- Leverett Pond: dredging to remove 23,900 cy of sediment and debris; and bank, island, and landscape rehabilitation.

- Willow Pond: dredging to remove 5,900 cy of sediment and debris; and bank, path, and landscape rehabilitation.

- Wards Pond: dredging to remove 15,600 cy of sediment and debris; and bank and landscape rehabilitation.

Balancing Project Benefits and Impacts

The primary impacts associated with the project are beneficial, including critically needed improvements in flood control infrastructure, rehabilitation of one of the world's great works of landscape architecture, along with improvements in water quality and wildlife habitat. However, the proposed rehabilitation will result in the temporary disturbance of the Muddy River, public use of portions of the parklands, roadways, and pedestrian walkways. Short-term impacts during the construction period, and a summary of mitigation measures, include the following:

- Temporary water quality impacts from the staging area, from dredge and debris removal locations, and from the return water. Among the measures to mitigate these impacts are the following: return water will be treated prior to discharge, areas to be dredged will be enclosed by silt curtains, and water quality will be monitored.

- Temporary impacts to vegetation at the staging area and adjacent to the river. However, no net loss of wetlands will occur as specific resource areas will be enhanced through wetland restoration and replication.

- Temporary impact to the limited aquatic and wildlife resources. However, the ultimate result of the project will be enhanced habitat, including the habitat of a state-threatened fish species, the Threespine Stickleback.

- Temporary impact on recreational use and pedestrian access. Again, temporary disturbances during construction will be balanced by the improvements as a result of project implementation.

The mechanisms to ensure that construction-related impacts are adequately mitigated include the following:

- Contract documents will include specifications or requirements that the contractor must meet to reduce environmental impacts; and

- The contractor will prepare plans for approval describing how work will be conducted, including:

    - Dredged Material Plan
    - Stormwater/Dewatering Pollution Prevention Plan
    - Environmental Monitoring and Sampling Plan
    - Plan for Monitoring of Wetland, Shoreline and Landscape Restoration
    - Pest Control Plan
    - Traffic Management Plan
    - Transportation and Disposal Plan
    - Plan for Monitoring of the Three-Spine Stickleback
    - Public Outreach Program

A Resident Engineer and an Independent Environmental Monitor (IEM) will monitor compliance with the contract documents and contractor's submitted plans. The IEM will be part of the proponent's construction monitoring team, but not responsible for the construction contract's commercial terms. The IEM will report violations of the mitigation measures and environmental permits to the construction management team.

Protecting the Investment

Phase I implementation will require nearly $100 million from federal, state, local and private sources. To ensure that this significant monetary investment is protected for the future, a management and maintenance plan has been developed. The plan identifies the management, staffing, equipment, and procedures needed to sustain the Phase I dredging, daylighting, revegetation, establishment of BMPs, and other related construction.

Management Structure

The Muddy River project area is managed by Boston Parks and Recreation Department, Town of Brookline Parks and Open Space Division, and the MDC.

In 1999, the City of Boston and Town of Brookline signed a Memorandum of Agreement (MOA) detailing the financial and management terms for conducting the project. The MOA identified the responsibilities for Boston and Brookline in contracting for services and sharing information on the project. There was no specific definition of the level of funding required by either party or source of other funds.

Also signed in 1999 was a Memorandum of Understanding (MOU) containing the responsibilities for funding and administering the project. In summary, the MOU identified the City of Boston through its Parks and Recreation Department as the project manager of Phase I of the project. The City receives and disburses funds for the project in cooperation with other participating agencies. The proponents agreed to accept responsibility for costs of maintaining and managing the project, including implementation of BMPs once Phase I is complete.

These two agreements will be renegotiated as part of continuing work on the Muddy River Project. Two new agreements are anticipated at the end of negotiations. The first is an agreement on management structure and maintenance responsibilities that will include the MDC as part of the agreement. This will replace the 1999 MOA. The second agreement is a financial MOU outlining the fiscal responsibilities of the parties including the EOEA and U.S. Army Corps of Engineers. The second agreement will replace the 1999 MOU.

The Challenge: Ongoing Management and Maintenance

The Muddy River Phase I project presents a unique challenge because it involves work in three jurisdictions with separate resources and funding commitments. The parks and the river form part of the boundary between Boston and Brookline. Despite the physical boundary of the waterway, many voices have expressed a desire for a "seamless" park system. Park users should be able to enjoy the parks without distraction, moving freely and with pleasure from city to town, path to bridge, woodland to overlook, experiencing the diversity of spaces Olmsted envisioned.

The proponents addressed the vision of "seamlessness" by developing a management and maintenance system that will ensure cooperation and consistency. The management model will not, however, diminish the role of regulatory bodies or those committees formed in the regulatory process.

The proposed management model is a Public/Private Partnership with Boston, Brookline and the MDC as the public entities and the Emerald Necklace Conservancy serving as the private sector partner. The proposed structure is designed to ensure that the goals of the Muddy River project are met through cooperative management and appropriate responsibility for long-term maintenance activities. The partnership is complemented by and represented on an Environmental Improvements Committee that will serve as an independent oversight body for the project, at the request of the Secretary of Environmental Affairs.

Parkland Maintenance Plan

Parkland maintenance falls under the responsibility of Boston Parks and Recreation, Brookline Parks and Open Space and the MDC. These agencies provide dedicated work crews for specific areas to ensure continuity in carrying out maintenance activities.

A maintenance plan has been developed to recommend standards to guide the maintenance of the project area after Phase I is constructed. The plan consists of a series of maps of the project area indicating physical maintenance areas with a description of overall maintenance activities and schedule. The plan is designed for use by supervisors and foremen in the field. The staff level necessary to carry out the plan has also been identified, including measures to compensate for staffing shortfalls (such as additional staff training and participation of other organizations along the Muddy River).

Monitoring and Maintenance to Ensure Effectiveness

Beyond general parkland maintenance activities, the long-term success of the Phase I improvements depends on the ongoing monitoring of project successes and needs, and corresponding maintenance to ensure that structural and non-structural elements are contributing to the goals of the project.

Culverts and Best Management Practices

As new culverts are constructed under this project, monitoring and maintenance will be required to ensure that the facilities operate at full capacity to pass storm flows.

Once new BMPs are implemented and existing BMPs are improved, a monitoring and maintenance plan will be followed to evaluate and ensure the effectiveness of the BMPs and to reduce the need for future capital expenditures. For new structural BMPs, maintenance involves inspection and cleaning at regular intervals. If proper maintenance is carried through, the project life of the new systems will be maximized.

Corrective and Maintenance Measures Following Storm Events

The maintenance plan also includes preventative, corrective and emergency actions to be conducted before, during, and following a storm event of a specific magnitude.

Pest and Rodent Control

This portion of the maintenance plan addresses the control of ducks and geese, as well as control of rodents.

Water Quality Monitoring

Long-term monitoring of water quality will occur at designated locations to gage water quality as related to meeting DEP Class B waters and also progress towards reducing sediment loads on the river basin.

Observations on the Growth and Success of Plantings

The project proponents will inspect the wetland and other habitat plantings to assess the success of the effort and to re-evaluate and adjust planting efforts as required. The success of efforts to control invasive species currently overgrowing the river will also be monitored.

Monitoring of Fish and Wildlife Distribution and Reproduction

Changes in distribution and species composition of fish and wildlife will be monitored to determine the extent of improvement. This information will also add to the scientific data base on the Muddy River.

Monitoring and Maintenance of Historic and Character Defining Features

One requirement of the project is that the proponents maintain the historic and character-defining features of the restored parks. To fulfill this requirement, the proponents will develop a report on annual site inspections to assess the condition of these features and to re-evaluate and adjust maintenance efforts as required.

Reporting and Accountability Beyond Project Construction

The longevity of the project is dependent on the monitoring and maintenance described above, which must be regularly documented and reviewed for consistency with project goals. There will be a number of reporting mechanisms in place after construction for ongoing monitoring and reporting. These plans, procedures and reports will document project successes and needs relative to the monitoring and maintenance activities summarized above.

The City of Boston, Town of Brookline and the MDC, to the extent defined in the new MOA and MOU, will share responsibility for implementing the long-term maintenance requirements and providing necessary documentation, assisted by the Public/Private Partnership previously described and with contributions from the Environmental Improvements Commission, Citizens Advisory Committee, and other interested parties.

The MEPA Annual Update

Annual updates to the Massachusetts Environmental Policy Act (MEPA) office are required for all phases of this project. The updates will be filed yearly as a means of informing the Secretary of EOEA and the public of progress on project implementation, monitoring and effectiveness of mitigation and replanting. The annual updates will include much of the information described below, in total or in summary form.

Environmental Permits and Approvals For Maintenance

Many of the approvals and permits to be obtained from federal, state, and local regulatory authorities will contain requirements for ongoing monitoring and reporting.

Report and Logs – Quality Assurance

A series of logs or monitoring reports will be prepared at appropriate intervals to document that the project is accomplishing its goals. These reports include maintenance logs for park staff, as well as reporting on water quality, BMP maintenance, plantings, fisheries and wildlife, and condition of historic features, as previously outlined.

Project Costs, Funding and Schedule

The estimated capital cost of project construction (for Phase I, excluding Charlesgate) is roughly $89 million. This cost includes design and construction of the various project elements, including capital costs for the treatment control or structural BMPs in the watershed.

A funding strategy for the capital costs has been formulated involving contributions from federal, state, and municipal sources. The U.S. Army Corps of Engineers has been authorized by the Congress in the Water Resources Development Act of 2000 (WRDA2000) to undertake the Muddy River project for flood damage reduction and environmental restoration. Also, the Commonwealth of Massachusetts has committed to provide significant capital funding (included in Environmental Bond Bill of 2002). The municipalities of Boston and Brookline, having partnered with the state and federal agencies in funding the first $7 million, are committed to obtaining capital funds to supplement the federal and state sources. The City and Town, as co-proponents, have also agreed to accept responsibility for costs of maintaining and managing the project, including BMPs, once Phase I construction is complete.

Project finances will be detailed in the renegotiated Memorandum of Understanding.

Final design of Phase I (Back Bay Fens to Ward's Pond) is expected to begin in 2003, with construction beginning in 2004.

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Section One

Section 1
Introduction

1.1 Background

This report is the Final Environmental Impact Report (EIR) for the Phase I Muddy River Flood Control, Water Quality and Wildlife Enhancement, and Historic Preservation Project ("the project"). The Final EIR responds to issues raised by the Secretary of Environmental Affairs and commenters on the Draft EIR, which was filed on January 31, 2002.

The project involves a multidisciplinary approach to improving the Muddy River system, adjacent parkland, and other areas that are part of what is referred to as the Emerald Necklace, located in Boston and Brookline, Massachusetts. Components of the project are derived from previous engineering and historical studies of the project area including the Emerald Necklace Parks Master Plan ("the Master Plan") by the City of Boston and Town of Brookline, and flood control studies by the Army Corps of Engineers (ACOE), the Executive Office of Environmental Affairs (EOEA), and the Federal Emergency Management Agency (FEMA).

Stakeholders with a common interest in restoring the Muddy River include Boston Parks and Recreation Department (which serves as the lead agency), the Town of Brookline, the Massachusetts Department of Environmental Management, the Metropolitan District Commission, and the Boston Water and Sewer Commission. Several other agencies and entities also have actively supported the project, including The Emerald Necklace Conservancy (ENC), the ACOE, EOEA, FEMA, the Department of Federal Housing and Urban Development (HUD), and the Massachusetts Emergency Management Agency (MEMA). Many non-profit environmental groups, neighborhood groups and individual citizens have worked in cooperation on the project as well.

Such a diverse group of project advocates and supporters need to build consensus and coordinate their efforts for the project to be successful. By using a public process that includes a Technical Advisory Group (consisting of Federal, State and local personnel), a Pre-Application Review Committee made up of regulators and a Citizens Advisory Committee (appointed by Secretary of the Executive Office of Environmental Affairs), all stakeholders can contribute to the project. Additional public outreach through public information meetings and speaking opportunities further broadens project input. Lastly, the organization of the Emerald Necklace Conservancy provides the structure through which the private sector can support the project.

The project area, located in Boston and in Brookline (see Figure 1-1, Site Locus), is surrounded by a variety of land uses including historic parkways designed for pleasure vehicle use, educational and art institutions, medical facilities, residential development, and more. The Emerald Necklace Master Plan covered the park

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Figure 1-1
Site Location

network from Back Bay to Franklin Park. The Phase I Muddy River Flood Control, Water Quality and Wildlife Enhancement and Historic Preservation Project covers only the Muddy River watershed, defined as the area beginning with the Muddy River confluence with the Charles River, and extending 3.5 miles upstream to Wards Pond (see Figure 1-1). The project area includes:

- The Charlesgate area (Boylston Street to the Charles River);
- The Back Bay Fens (The Riverway at the former Sears Parking Lot to Boylston Street);
- The Riverway (The Riverway at the former Sears Parking Lot to Leverett Pond);
- Leverett Pond;
- Willow Pond; and
- Ward's Pond.

1.2 Project Purpose and Need

1.2.1 Development Impacts on the Emerald Necklace

The Emerald Necklace Park system is composed of a series of parklands and historic pleasure vehicular parkways. A significant number of parks are linked by the elements of the Muddy River system: The Back Bay Fens, The Riverway, Leverett Pond, Willow Pond, Wards Pond, and Jamaica Pond. All of these water bodies and wetlands are central features of the Emerald Necklace System. This system of integrated parks and parkways, designed by the country's most famous landscape architect, Frederick Law Olmsted and his associates during the last two decades of the nineteenth century, has great historical significance as his most ambitious undertaking involving landscape architecture, metropolitan planning and engineering. In particular, Olmsted transformed the Back Bay Fens and Riverway sections, creating entirely new landscapes by dredging and filling, supplemented by nearly complete revegetation in order to create new and original scenery. He also employed the civil and sanitary engineering needed to make the watercourses functional and protected against flooding. Into these spaces he introduced a complex system of walks, bridle paths, and carriage drives to facilitate movement through the city and to provide for recreational enjoyment of the scenery.

Since its creation around the turn of the twentieth century, the Emerald Necklace in general, and the area surrounding the Muddy River in particular, have been subject to the effects of gradual yet extensive urbanization. As the populations of Boston and Brookline grew, they brought with them the attendant expansion of buildings, roadways, traffic, and congestion. The results of development on the watershed have been significant. Flooding has worsened because there is little natural storage left in the widely paved watershed, and sediment and debris have washed into the river, choking off flood carrying capacity. Water quality has deteriorated as an array of natural and man-made compounds are carried off the land surface during rainstorms

and deposited into the river. The construction of the Charles River Dam in 1805-6 forever altered the ecosystem and hydrologic design of the Emerald Necklace, changing a tidal estuary into a low gradient freshwater stream. Non-native invasive species of flora such as *Phragmites* and knotweed have overtaken portions of the river, pushing out native species, creating safety hazards, eliminating natural habitats and greatly limiting the diversity of wildlife that can live within the watershed. The distinctive landscape designed by Frederick Law Olmsted has declined in richness and diversity, the present landscape lacking the subtlety and coherent massing of plant materials that once characterized the original landscape.

1.2.2 Project Objectives

As shown in Figure 1-2, Project Objectives, the project is designed to meet a number of objectives. Each objective is included to address specific problems that have developed over time and/or to maximize the benefits to be derived from the proposed improvements. The following summarizes the problems to be addressed.

Provide Flood Control. In October 1996, the Muddy River flooded as a result of a storm that deposited 5.45 inches of rain in a period of 24 hours, and incurred damages estimated at $63M for the Muddy River, the MBTA and Stony Brook Conduit. (Damage estimate provided by the US Corps of Engineers for public damages. FEMA reported alternative avoided damages between $74 and $117 million including public and private damage.) Analyses conducted subsequently show that the 1996 storm flows overwhelmed the Muddy River capacity as a result of the increase in impervious area within the watershed over time, and constrictions in flow capacity caused by inadequate culvert sizes where the Muddy River has been culverted under the former Sears parking lot and at the Fens Bridge. The encroachment of invasive species and the deposition of sediment also have reduced the flood-carrying capacity in certain sections of the channel. The project will improve flood control by increasing culvert capacity and removing flow restrictions in the waterway.

Improve Water Quality. Urban runoff and storm drain discharges have resulted in sedimentation, a reduction in dissolved oxygen, increased turbidity, and other contaminants have been found in both the water column and in river sediments. These discharges have contributed to the water quality degradation experienced along some portions of the Muddy River. Removing contaminated and organically enriched sediments, stabilizing banks where needed, and implementing other measures (such as over-dredging and instituting Best Management Practices, or BMPs), are intended to address the water quality problem in the Muddy River.

Enhance Aquatic and Riparian Habitat. Much of the sediment in the river is contaminated with compounds typically found in urban environments (e.g., metals). Removal will result in improved aquatic habitat. Reconstructing or replanting historic islands will also improve the aquatic and riparian habitat. In addition, the replanting plan for disturbed riparian areas entails providing a diverse habitat and where appropriate, replacing invasive species that have overtaken certain areas with a

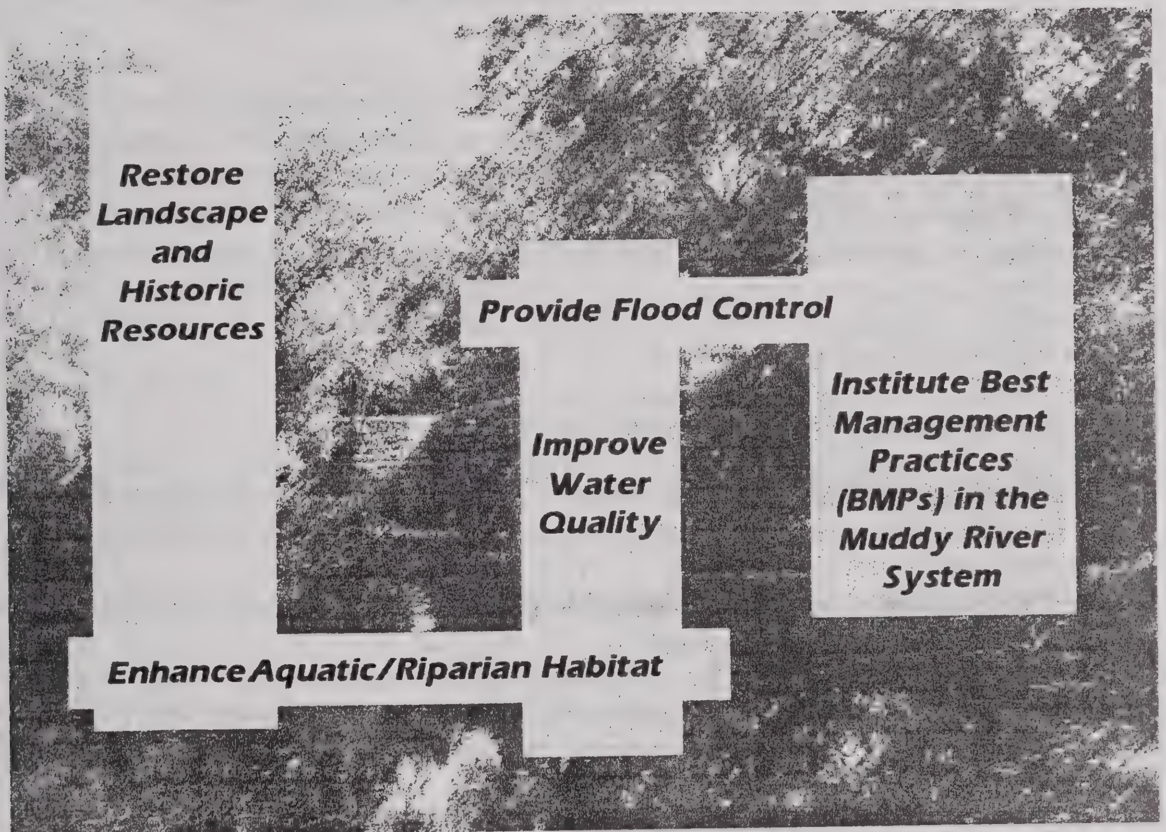


Figure 1-2
Project Objectives

CDM

variety of plantings to provide improved wildlife habitat.

Institute Best Management Practices in the Muddy River System. Since 1898, portions of the Muddy River have been dredged approximately every thirty years as a result of cyclical sedimentation accumulation. The implementation of Best Management Practices (BMPs) is intended to maximize the life span of the improvements for the other project objectives, i.e., flood control, water quality, habitat enhancement, and historic resources. BMPs will be an integral component of the overall plan to protect the public's investment in this valuable resource.

Restore Landscape and Historic Resources. The distinctively designed landscape of the Emerald Necklace Parks has declined due to inattention and the vanishing of many species that were an integral part of the parks. Significant areas have been overtaken by invasive species, including *Phragmites,* Japanese Knotweed, and glossy buckthorn. In order to rehabilitate and preserve the historic landscape and historic resources, the following actions are necessary, either individually or in combination:

- Remove invasive vegetation;
- Protect historic resources from damage due to construction;
- Preserve and rehabilitate the historic river bank configuration along the Muddy River, including restoration of the historic islands; and
- Plant vegetation in keeping with the historic landscape design, guided by the Emerald Necklace Master Plan.

The implementation and accomplishment of these actions will meet this Project Objective and will increase vegetative, structural, and wildlife diversity substantially.

1.3 Description of the Preferred Alternative

1.3.1 Phase I of the Emerald Necklace Environmental Improvements Master Plan

The project, as described herein, comprises Phase I of the 1999 Emerald Necklace Environmental Improvements Master Plan, and is consistent with the overall Emerald Necklace Parks Master Plan, which was prepared in 1989 by Walmsley, Pressley Joint Venture and updated in 2001 by Pressley Associates Inc. The overall Master Plan represents a plan for the preservation and long range management of the four parks that constitute the Muddy River chain of parks of the Emerald Necklace--Jamaica Pond, Olmsted Park, The Riverway and the Back Bay Fens, designed by Frederick Law Olmsted in the period from 1878 to 1895.

Each of the improvements discussed in this report can be categorized as being associated with dredging, infrastructure improvements, BMPs, wetlands restoration/bank stabilization, and historic landscape improvements. Dredging,

infrastructure improvements and BMPs are proposed primarily as flood control and water quality improvement measures. Project elements falling into the other of these categories are intended to ensure the long-term effectiveness of the flood control and water quality improvement measures and to preserve the historic integrity of the Emerald Necklace.

The timing and duration of the project elements will be determined by funding availability and environmental constraints. However, as previously proposed in the ENF and the Emerald Necklace Environmental Improvements Master Plan, a general phasing plan consists of the following:

Phase I - Muddy River Dredging, Flood Control, Water Quality Improvements, Aquatic/Riparian Habitat Enhancement, Historic Restoration, and Best Management Practices

Phase II - Historic Landscape Improvements, Revegetation, Traffic Circulation Improvements, Building and Bridge Restoration.

Phase III - Traffic Circulation Improvements, Building and Bridge Restoration.

Phase IV - Jamaica Pond, Arnold Arboretum, Scarborough Pond, etc.

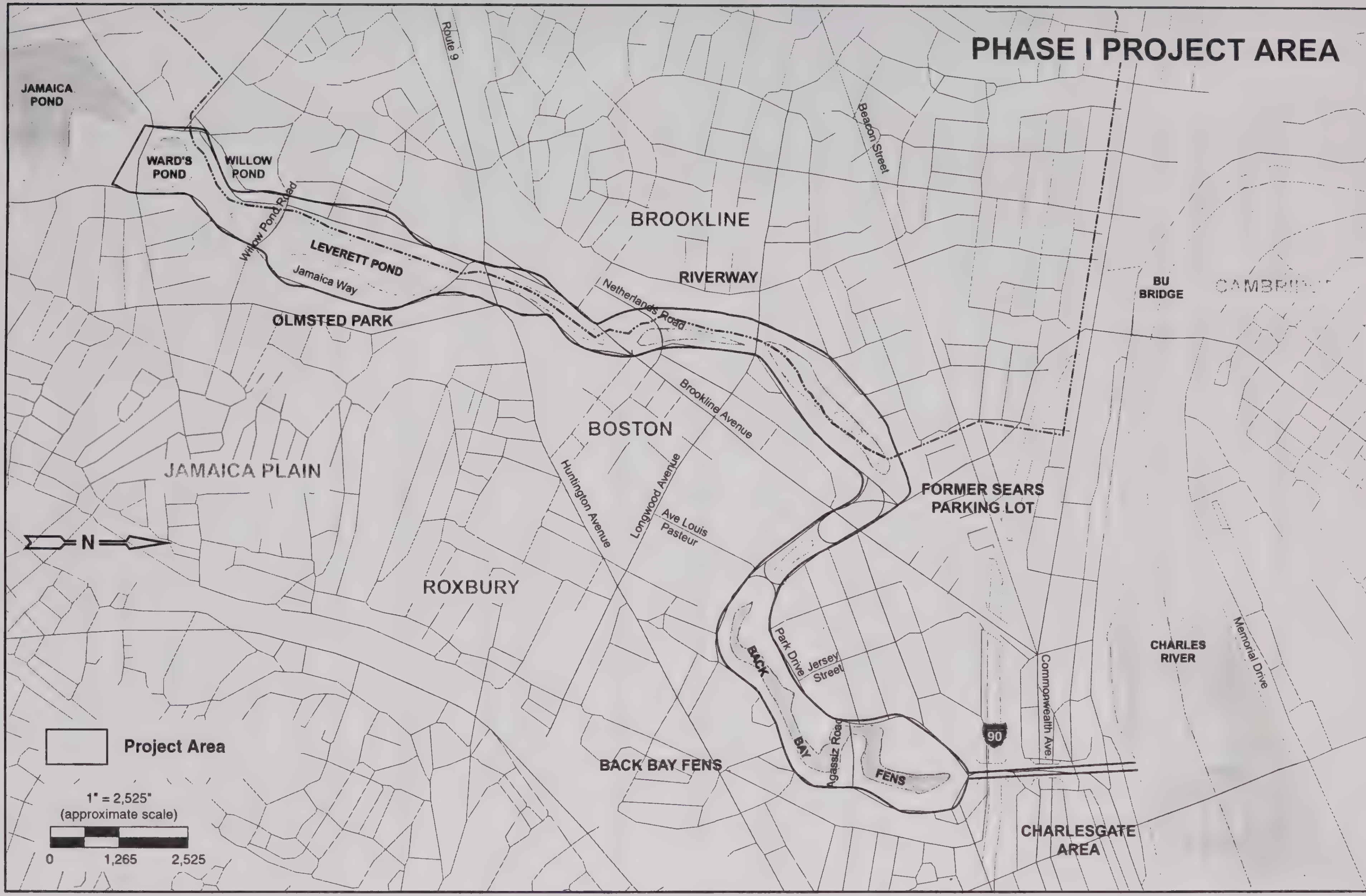
This FEIR focuses primarily on Phase I project elements (and specifically Phase 1B as described below), while it also addresses a process for review of subsequent phases. The Phase I elements have been further divided into:

IA- Charlesgate Area (Boylston Street to Charles River)

IB- Muddy River (Wards Pond to Ipswich Street, which includes The Back Bay Fens Area, The Riverway, and The Olmsted Park - i.e., Leverett Pond, Willow Pond, and Wards Pond).

Sections of Phase I of the Muddy River Project are depicted in Figure 1-3. Generally, implementation of elements within these geographic sections of the project will occur subsequent to the approval of the Final Environmental Impact Report. An exception relates to Charlesgate improvements, which are a subset of Phase I. Authorization has been obtained for Charlesgate activities to proceed in advance of this FEIR. Elements not identified as part of Charlesgate or Phase I will proceed based on funding availability, regulatory approvals and submission of an impact assessment in the MEPA Annual Update.

Phase I implementation approach involves riverbank stabilization, replanting wetlands and implementing landscape improvements in concert with the construction sequencing of flood control and other structural improvements. By implementing these measures, areas that are disturbed for construction or dredging activities may benefit from landscape improvements earlier than other segments of the project. All landscape improvements, (e.g. lawn plantings, specimen tree and shrub plantings) and improvements to buildings/light fixtures etc., will be performed after all heavy



Source: CDM

CDM

Figure 1-3
Phase I Project Area

equipment has been removed from the site(s), thereby offsetting any resultant damage during the construction process.

1.3.2 Preferred Alternative Activities

Specific activities comprising the preferred alternative in each of the geographic areas (The Back Bay Fens area, The Riverway, Leverett Pond, Willow Pond, and Wards Pond) are outlined below:

- Back Bay Fens: daylighting culverts at the Fens Bridge and former Sears parking lot to restore the Olmsted-designed shoreline; bank-to-bank dredging to remove 95,500 cubic yards (cy) of sediment and debris, and 23,500 cy of *Phragmites*; installing new arch culverts under the Riverway and Brookline Avenue; improvements to roadway storm drain systems; and bank and landscape rehabilitation.

- The Riverway: bank-to-bank dredging to remove 21,200 cy of sediment and debris, and 10,000 cy of *Phragmites*; improvements to roadway storm drain systems; and bank and landscape rehabilitation.

- Leverett Pond: dredging to remove 23,900 cy of sediment and debris; and bank, island, and landscape rehabilitation.

- Willow Pond: dredging to remove 5,900 cy of sediment and debris; and bank, path, and landscape rehabilitation.

- Wards Pond: dredging to remove 15,600 cy of sediment and debris; and bank and landscape rehabilitation.

As required by the MEPA scope, the preferred alternative also includes project-wide BMPs and a maintenance and management plan. The proposed BMPs include both structural and source control BMPs, including street sweeping, catch basin cleaning, and particle separators.

1.4 Summary of Impacts and Mitigation Measures

1.4.1 Introduction

The primary impacts associated with the project are beneficial, including critically needed improvements in flood control infrastructure, rehabilitation of one of the world's great works of landscape architecture, along with improvements in water quality and wildlife habitat. However, the proposed rehabilitation will result in the temporary disturbance of the Muddy River, public use of portions of the parklands, roadways, and pedestrian walkways. Specifically, staging areas for dredging and other activities will contain some combination of sedimentation tanks, pumps, coagulant polymer feed systems, belt filter presses, water filters, conveyor belts for truck loading, a field office, and/or limited construction parking. The former Sears parking lot will further be the site of construction activities related to construction of an arch culvert under The Riverway and Brookline Avenue. Long-term physical

alterations will occur at the Fens Bridge and former Sears parking lot, where culverted sections are restored to more natural ecosystems and historic configurations.

Specific impacts related to project implementation are summarized below.

1.4.2 Sediment Quality

Muddy River sediment consists of organic silt, fine-to-coarse sand, and gravel. At various locations along the river the sediment also contains decayed plant matter, sticks, peat, bricks, wood glass, and pieces of concrete. Sediments in the river are also documented to contain elevated levels of metals, PAHs, and petroleum hydrocarbons, with PCBs and DDT (and its metabolites) also found frequently. The Army Corps of Engineers analyzed sediment contamination and concluded that contaminant concentrations are higher in surface sediment and decline with depth (USACE. 2002). Accumulated sediments will be removed to depths ranging from one to five feet. Contaminated sediments will be handled according to state and federal laws and regulations. This removal will increase river flow capacity and improve overall sediment quality.

1.4.3 Water Quality

Construction activities will temporarily affect the Muddy River's water quality. Runoff from the staging areas, dredging operations, and return water from the belt filter presses will increase turbidity in the river. The durations will be short, and due to the extremely low flow volume of the Muddy River, the area affected will be limited. The return water will be treated so that total suspended solids (TSS) are less than 40 mg/l and the dissolved oxygen level is at least 5 mg/l.

1.4.4 Benthic Resources

Dredging will result in a temporary loss of benthic species (e.g., worms, midges and other invertebrates), which are presently dominated by pollution-tolerant organisms. Some remaining benthic species are expected to act as seed for regrowth. However, the new community is likely to be less dominated by pollution-tolerant organisms as clean water benthic species begin to proliferate.

1.4.5 Fish Resources

It is anticipated that dredging will kill some fish (although no dredging will occur during the spring fish migratory period between March 1 and June 15). The fish loss may be proportionally higher in the bottom-dwelling species than the open-water species (the Muddy River would actually benefit from substantially fewer bottom-dwelling species). Because Spring Pond contains a rare fish species, the three-spine stickleback, no construction work will directly affect Spring Pond. The stickleback has also been found in a small pool in Willow Pond where the water from Spring Pond falls below a small stone dam. Sticklebacks in this pool will be temporarily relocated to a holding pond and the Willow Pond pool will be preserved by silt curtains and sheeting during dredging in Willow Pond. The stone dam will be repaired.

1.4.6 Wetlands

The proposed work includes the removal of *Phragmites*, including the extensive root system. Where one species dominates the present ecosystem, several species of shoreline and emergent plans will replace it. This will result in a substantial enhancement of the functions and values of the aquatic, wetlands, and upland ecosystems as well as a commensurate enhancement in wildlife functions and values. The proposed project will result in "no net loss" of wetland resources.

1.4.7 Wildlife Resources

In locations where dredging occurs during winter hibernation, amphibians and reptiles that are not relocated will be lost. The contractor will be required to hire a wildlife biologist to relocate some wildlife before construction begins and to return them after construction. After construction, the upland wildlife community will benefit significantly from the revegetated landscape that will feature a diverse plant selection adapted from the Olmsted plant list (excluding currently known invasive species).

1.4.8 Ecological Functions and Values

Dredging will temporarily impact the current habitat's function and values. Long-term physical alterations are related to bank stabilization, deepening of the water body, reconstruction of an island, and the enhancement of the aquatic and upland ecosystems to more natural ecosystems.

The project construction as a whole, including dredging and dredged material management, will also affect pedestrian access and traffic, and generate noise.

1.4.9 Mitigation

Mitigation of construction-related impacts will be implemented in two ways:

- Contract documents will include specifications on requirements that the contractor must meet to reduce environmental impacts; and
- The contractor will prepare plans for approval on how work will be conducted to limit environmental impacts. These plans include, but are not limited, to:

  - Dredging and Dredged Material Management
  - Stormwater/Dewatering Pollution Prevention Plan
  - Water Quality Monitoring
  - Traffic Mitigation Plan
  - Rodent Control Plan
  - Historic and Natural Resources

A Resident Engineer and an Independent Environmental Monitor will monitor compliance with the contract documents and contractor's submitted plans. The IEM will be part of the proponent's construction monitoring team, but not responsible for the construction contract's commercial terms. The IEM will report violations of the mitigation measures and environmental permits to the construction management team.

1.5 Previous MEPA Submittals and MEPA Requirements

The Massachusetts Environmental Policy Act Unit (MEPA) is the agency of the Commonwealth with responsibility for environmental impact review. Projects that require certain state approvals, that meet or exceed impact-related thresholds, and/or that require state funding are subject to review under MEPA. The extent of the process can vary depending on the project, but common to all projects is a requirement for public disclosure and comment.

1.5.1 Environmental Notification Form/Notices of Project Change

For the Muddy River Project, an Environmental Notification Form (ENF) was submitted to the state in January 1999. The Secretary issued two Certificates on the ENF on April 29, 1999 -- one for the scope and requirements for the EIR, the other establishing a special review procedure, as outlined below:

- A Draft and Final EIR covering the entirety of the project;
- An opportunity for the Charlesgate portion of the project to proceed following the MEPA review and certification of the Draft EIR; and
- Filing and public review of updates on the project progress annually after the Final EIR review is completed.

In addition, the special review process included the designation of a Citizens Advisory Committee (CAC) by the Secretary of Environmental Affairs, as described further in Section 1.5.3.

Two Notices of Project Change (NPCs) were also filed in 2001. The first NPC involved separation of the combined sanitary/storm sewer to a separate storm drain and sanitary sewer system at the Boston Park and Recreation Department's Back Bay Yard. The second NPC involved cutting and removal of plant material at the Agassiz Bridge. The Secretary of Environmental Affairs determined that neither NPC required further environmental review in Certificates issued on September 21, 2001 and October 15, 2001, respectively.

1.5.2 Establishment of the Citizen's Advisory Committee

At the request of the project proponents in the ENF, a CAC has been established to assist the Secretary in the environmental review of this project. Supported by project proponents administratively, the CAC met regularly (i.e., 52 times between

September 1999 and December 2002) with the proponents and their consultants to provide input on all aspects of the project. The CAC also held meetings to inform the public on the project status. Early drafts of Final EIR sections were also provided to the CAC for review and comment prior to finalization. A description of CAC meetings held since the Draft EIR is contained in Appendix C.

1.5.3 Draft and Final Environmental Impact Reports

The Draft EIR was filed in January 2002. Two Certificates were issued by the Secretary of Environmental Affairs on April 16, 2002 – one on the Draft EIR, indicating that it "adequately and properly complies with the Massachusetts Environmental Policy Act" (see Appendix A) and a Draft Record of Decision (ROD) allowing the Charlesgate element of the project to proceed to permitting prior to submission of the Final EIR (see Appendix B).

The Draft ROD Certificate proposed to grant a Phase One Waiver allowing the Charlesgate element of the project to proceed to the state permitting agencies pending completion of the Final EIR and subject to the satisfaction of conditions.

The project proponents submitted a letter to MEPA on July 1, 2002 (see Appendix B) in response to the requirements of the Draft ROD. The Final ROD, issued by the Secretary on July 29, 2002 (also in Appendix B), granted the Phase One Waiver for Charlesgate and acknowledged compliance with most of the requirements of the Draft ROD. The requirements included:

- Creation of a workplan and schedule for implementation and maintenance of basin-wide non-structural BMPs. The work plan also needs to expand on treatment and maintenance for the Charlesgate element and address permitting requirements of the MDC;

- Commitment to completion of basin-wide evaluative studies for potential structural BMPs during 2002 so that results can be fully reflected in the Final EIR;

- Maintenance of the project schedule presented in the Draft EIR (submit Final EIR no later than January 31, 2003);

- Creation of a dedicated funding source to support basin-wide BMP implementation and other maintenance measures; and

- Implementation of a management structure, through the creation of an independent oversight body, representing the full range of stakeholders.

The most significant issue requiring further evaluation is the structure and function of the independent oversight committee. The Final ROD required that all outstanding issues related to the management and structure of the committee be resolved by December 1, 2002. These issues were addressed in a November 27, 2002 letter to the Secretary of EOEA (see Appendix B).

The Certificate on the Draft EIR, issued on April 16, 2002, stated that the Draft EIR provided enough information to demonstrate that the preferred alternative generally minimizes environmental impacts, and presents a generally complete description of the project, its alternatives, and its impacts. However, several important issues were noted as being unresolved. Specifically, the Secretary called for more detailed information on wetlands and water quality impacts; more information on alternatives; a more detailed, specific, and enforceable Maintenance and Management Plan; responses to the numerous comments on the Draft EIR; and responses to other issues outlined in the Certificate. The Secretary also noted that the Final EIR may incorporate by reference those portions of the Draft EIR that do not require further analysis.

The document contained herein is the Final EIR, which addresses the issues raised by the Secretary in his Certificate on the Draft EIR and relevant comments submitted by interested parties.

1.5.4 Annual Update

The special review procedure for the Muddy River Project mandates that the MEPA office and project commenters be updated annually following the completion of the Final EIR. Of interest are the status of physical improvements, management practices, and information regarding current environmental conditions gathered through monitoring, The Annual Updates also will provide the necessary documentation regarding later phases of the project whose impacts are not evaluated in detail in this Final EIR.

The first Annual Update is anticipated to be filed one year after construction commences, probably during the last quarter in 2003.

As required by the Secretary of Environmental Affairs, a proposed outline reflecting a scope of work for the Annual Updates for the project has been prepared (see Section 6 of this Final EIR). The concept of continuity drives this outline, as does a need for flexibility with respect to the sequencing of future project phases. Each report will build upon the report that proceeds it, providing an update with respect to interim progress in implementation of funded project elements and on success with regard to funding of future project elements. The Annual Update will be circulated to all parties who commented on either the ENF or EIR.

1.6 Project Updates Since Draft EIR

1.6.1 Summary of Record of Decision Status and Compliance

The proponents have completed the following activities pursuant to the Final Record of Decision:

- Created a work plan and schedule for implementing basin-wide non-structural BMPs;
- Clarified the maintenance commitments for Charlesgate;

- Committed to evaluating and preparing a basin-wide structural BMP plan. Plan is currently under review. Pilot study of structural BMP has been started with preparation of sampling plan;
- Proponents are proceeding with a January 31, 2003 submittal of the FEIR;
- Letters were submitted to MEPA regarding dedicated funding sources; and
- Independent oversight body has been formed and held four meetings between October and December 2002. A chairperson has been selected and a draft position description prepared for a paid staff member.

1.6.2 State and Local MOU for Funding and Administering the Project

In November 1999, a Memorandum of Understanding (MOU) amongst local and state agencies involved in the project was executed. Its purpose is to facilitate cooperation amongst the respective authorities in project planning, permitting, funding, and implementation. The MOU allows for the transfer of funds between participating parties and provides commitments for adherence to all applicable regulatory or programmatic requirements. It also summarizes financial commitments for Phase 1 of the project from participants.

It is expected that the MOU will be amended to include the MDC as a signatory and provide further commitments on funding of capital costs and maintenance by the proponents and funding agencies.

1.7 Overview of Document Contents

This Final EIR contains the following information:

- Section 1 – Introduction
- Section 2 – Dredging and Sediment Management
- Section 3 – Wetland and Water Quality Impacts and Mitigation for Dredging
- Section 4 – Wetlands Protection Act and Water Quality Certification Compliance
- Section 5 – Watershed Evaluation and Best Management Practices
- Section 6 – Management Structure and Maintenance Plan
- Section 7 – Historic Resources
- Section 8 – Back Bay Yard
- Section 9 – Rare Species Habitat Evaluation
- Section 10 – Mitigation and Section 61 Findings

- Section 11 - DEIR Comments
- Section 12 – Wetland Figures

In addition, the Final EIR contains a number of supporting appendices.

2

Section Two

Section 2

Section 2
Dredging and Sediment Management

2.1 Introduction

Dredging and sediment management are discussed below in four major sub-sections:

- MEPA Certificate and Draft EIR comment summary (Section 2.2);
- The proposed dredging plan and sediment management (Section 2.3);
- The dredging and sediment management in each geographic area as presented in the Draft EIR (Section 2.4);
- Impacts from dredging activities and mitigation measures to address identified impacts (Section 2.5); and
- Responses to specific comments on the Draft EIR (Section 2.6).

2.2 MEPA Certificate and DEIR Comments

The MEPA Certificate on the Draft EIR stated that the Final EIR should:

- Provide more details on the dewatering process and sediment management in general; and
- Address DEP comments concerning sediment sampling and management protocols.

Section 2.6 provides responses to these issues.

2.3 Overview of Proposed Dredging Plan and Sediment Management

2.3.1 Introduction

This section presents the overall general plan for dredging the Muddy River. It supplements the Draft EIR by providing the sequence of activities for dredging, which is applicable to all dredging locations.

The Draft EIR Section 2, Section 5, and Appendix I Preliminary Design Report present the detailed dredging plan for each area of the Muddy River. A chart describing the elements of the dredging plan is included here in Table 2-1, and is discussed in more detail in Section 2.4.

Dredging will be performed in two segments. The first will be the Charlesgate area (this work is currently being conducted through a MEPA Phase I Waiver) and the second will be from Back Bay Fens upstream to Wards Pond. Culvert construction and daylighting will be completed after dredging because these areas are needed for

TABLE 2-1
PROPOSED DREDGING PLAN BY AREA

PROJECT AREA	DREDGING PLAN STEPS				
	1. Staging Area	2. Phragmites Removal and Sediment Dredging	3. Special Sediment Processing	4. Estimated Sediment Reuse/Disposal	5. Post-Dredging/Construction Activities
Back Bay Fens	- Agassiz, Lagoon, and Louis Pasteur - Charlesgate will be available for staging	- Mechanical removal of 23,500 cy of phragmites - Hydraulic dredging of 95,500 cy: a. 80,000 cy accumulated sediment and debris b. 15,500 cy of overdredging for sediment basins	- Treatment of 47,250 cy of TC-lead sediment at Lagoon and Agassiz staging areas, subject to DEP approval	- Disposal of 47,250 cy of TC-lead sediment in out-of-state landfill or reuse at in-state landfill if other criteria are met - Disposal of 71,750 cy in out-of-state landfill	- Revegetate new bank and establish wetland areas - Rehabilitate historic turf-covered shoreline - Restore and revegetate staging areas - Repair or replace worn pathways
The Riverway	- Netherlands Road - Fens at Avenue Louis Pasteur	- Mechanical removal of 10,000 cy of phragmites - Hydraulic dredging of 21,200 cy: a. 18,500 cy accumulated sediment and debris b. 2,700 cy of overdredging for sediment basins - Possible use of mechanical dredging in Riverway South	- None	- Disposal of 22,600 cy in out-of-state landfill - 8,600 cy meet DEP criteria for in-state reuse	- Revegetate new bank and establish wetland areas - Rehabilitate historic turf-covered shoreline - Restore and revegetate staging area - Repair or replace worn pathways and rehabilitate historic islands
Leverett Pond	- Daisy Field for dewatering and possibly the former Kelly Rink for truck staging	- Hydraulic dredging of 23,900 cy: a. 21,800 cy of accumulated sediment and debris b. 2,100 cy of overdredging for sediment basins	- None	- Disposal of 16,700 cy in out-of-state landfill - 7,200 cy meet DEP criteria for in-state reuse	- Revegetate disturbed area - Restore Babbling Brook at pond inlet - Revegetate new bank and establish wetland areas - Rehabilitate historic turf-covered shoreline - Repair or replace worn pathways
Willow Pond	- Daisy Field for dewatering and possibly the former Kelly Rink for truck staging	- Hydraulic dredging of 5,900 cy: a. 5,100 cy of accumulated sediment and debris b. 800 cy of overdredging for sediment basins	- None	- Disposal of 5,900 cy in out-of-state landfill because of PAH and petroleum contamination	- Rehabilitate terrestrial habitat with indigenous planting and enhance habitat of the three-spined stickleback. - Restore historic natural bank and turf-covered shoreline - Revegetate new bank and establish wetland areas - Restore Daisy Field staging area - Repair or replace worn pathways
Wards Pond	- Daisy Field for dewatering and possibly the former Kelly Rink for truck staging - Parking area off the Chestnut St. side of the pond for equipment access	- Hydraulic dredging of 15,600 cy of accumulated sediment and debris	- Disposal at 1,500 cy of TC-lead sediment in out-of-state landfill or treatment at Daisy Field staging area, subject to DEP approval	- Disposal of 1,500 cy of TC-lead sediment in out-of-state landfill or reuse at in-state landfill if treated and if other criteria are met - Disposal of 14,100 cy in out-of-state landfill - 12,500 cy meet DEP criteria for in-state reuse	- Rehabilitate terrestrial habitat with indigenous planting - Establish wetland species in the outlet brook - Rehabilitate historic turf-covered shoreline - Restore access area - Repair or replace worn pathways

staging areas. Dredging cannot be performed during weather that is cold enough to freeze the water because it affects the dewatering process. Dredging is also prohibited during the period between March 1 and June 15 of any year in order to protect the habitat of river herring, blueback herring, and rainbow smelt.

Although each reach of the river and the ponds will be dredged sequentially, the five steps for each will be similar:

1. Mobilization and Initial Activities (Section 2.3.2)

2. Conduct *Phragmites* Removal and Dredging Operations (Section 2.3.3)

3. Sediment Dewatering at Staging Areas (Section 2.3.4),Ultimate Reuse/Disposal of Dewatered Sediment (Section 2.3.5), and

4. Post-Dredging/Construction Activities (Section 2.3.6).

Each of these steps is addressed below.

2.3.2 Mobilization and Initial Activities

During mobilization and initial construction activities, erosion and sediment controls will be installed, staging areas prepared, and pre-dredge "debris field" will be cleared.

2.3.2.1 Installation of Land-based Erosion and Sedimentation Control

Staging areas and locations for accessing the river will have erosion and sediment controls as described in specification section 02270 in Appendix I of the DEIR. Staked hay bales and siltation fences will be located between the wetland resource areas (whether Bank, Bordering Vegetated Wetland, or Land Under Water) and the designated access/staging area.

2.3.2.2 Preparation of Staging Areas

Actual construction staging will depend on the logical sequence of construction necessary to complete this work. The contractor will be required to submit a dredge work plan that will include construction and sequencing. Section 2.6.6 discusses the layout and specific activities proposed for the Agassiz and Lagoon staging areas. At all staging areas, the contractor will place a crushed stone layer over the staging area to minimize erosion of existing soil. All staging areas will also be lined prior to use to prevent contamination from spills. The staging areas will be secured and surrounded by chain-link fencing for pedestrian safety and site security. Only construction vehicles and equipment (and limited worker parking) will be allowed within staging areas. Where discussed in the Draft EIR, some travelways and pedestrian walkways will be temporarily closed to general traffic and pedestrians.

2.3.2.3 Pre-dredge Debris Field Clearance

The dredging contractor may need to perform some type of pre-dredge "debris field' clearance. The specifications will indicate that debris is anticipated and it is the

contractor's responsibility to remove the debris (as well as the sediment). Therefore, it will be up to the contractor to determine whether a pre-dredge debris field clearance is needed to meet the terms of the specifications. In Charlesgate, the debris includes shopping carts, bicycles, tires, clothing, wood, trash, etc. It is being removed by using a Gradall in the stream equipped with a modified tyne bucket. The tynes remove large debris and leave the sediment.

2.3.2.4 Installation of In-stream Sedimentation Control

During dredging, care will be taken to minimize erosion and sedimentation along the river and at the staging areas. Using hydraulic dredging methods will minimize re-suspension of sediment because the water serves as the transport medium for sediment and is pumped through the pipeline to the staging area. In addition, the dredge can be fitted with a hood near the cutter head that keeps re-suspended sediment close to the dredge. Where mechanical removal methods are used, silt curtains and oil absorbent booms will be placed in the river at either end of the dredge area to contain sediment. Return water from the belt filter presses will be discharged to the river within a silt curtain following treatment.

2.3.3 Dredging Operations and *Phragmites* Removal

The first phase of construction will entail channel dredging and management of the dredged material. Construction work from the staging areas will include dredging, removal of invasive species (such as *Phragmites*), refilling shoreline areas, and final regrading to historic shoreline configurations.

Removal of *Phragmites* will be accomplished by mechanical means (backhoe, low-impact excavator, or equivalent), and the root mass will be disposed of off site. *Phragmites* stalks and root mat will be removed using a combination of mechanical methods. This material does not contain much excess water; therefore it will be handled separately from the sediments to avoid increasing dewatering needs. The stalks will be cut by small all-terrain equipment or by hand where required, mulched, and loaded into small trucks for disposal. A small, barge-mounted backhoe or low-impact excavator that can be supported on the root mat will then remove the upper layer of the root mat and load it onto a spoils barge or truck. Care will be taken to minimize mixing the root mat with underlying sediment where it could clog the dredge and recolonize the sediment. Once the root mat is removed, the underlying sediment will be dredged with a hydraulic dredge.

The work conducted at Charlesgate suggests that the sediment in other parts of the river may contain more cobbles and boulders than indicated by the borings. (Cobbles range from 6 to 12 inches in diameter, and boulders are greater than 12 inches.) At Charlesgate, the presence of cobbles and boulders caused the contractor to propose

modified operations. The auger hydraulic dredge purchased by the contractor could not be used to remove the stones. Additional sediment testing will be done during design to determine if these materials are present elsewhere. An excavator will be used to sample the sediment for visual inspection to estimate the proportion of stones and debris. The sediment will then be returned to the river bottom.

Mechanical dredging and hydraulic dredging were re-evaluated based on the Charlesgate experience. The dredge manufacturer for Charlesgate indicated that a jetting ring that uses water jets to loosen sediments, but not stones, would be appropriate for the conditions there. Other modifications of the equipment may be used, such as a bar screen to keep rocks out of the pump. The cobbles and boulders may be allowed to remain in the river, provided that enough fine-grained sediment is removed to achieve the required depths. Overdredging may be necessary to accomplish this. As a result, hydraulic dredging is expected to remain the preferred method. If there are areas where hydraulic dredging is not feasible, mechanical dredging will be used.

Hydraulic dredging involves the use of a barge-mounted suction boom with a mechanically operated cutter head or jetting ring. The boom is positioned at the front of the barge and angled to the desired dredging elevation. The cutter head churns up the sediment and mixes it with water to form a slurry. The slurry is then sucked through a pump mounted on the barge and pumped through a pipeline connected to dewatering equipment on shore at the staging areas. Depths can be set so that the proper grades are maintained, and in some cases the cutter head can be fitted with a hood to minimize the amount of sediment that is re-suspended in the water.

Dredging equipment will enter the river and ponds directly from the staging areas. As described in the Draft EIR, the Back Bay Fens, the Riverway area, Leverett Pond and Wards Pond will be dredged hydraulically to the extent possible. A combination of hydraulic dredging and mechanical dredging with small, specially designed equipment may be required in the narrow, shallow river segments in Riverway South.

The dredged sediment will be pumped to a nearby staging area (one of six) for dewatering. *Phragmites* removed (where bank-to-bank dredging is proposed) will be loaded onto a spoils barge or truck.

2.3.4 Sediment Dewatering at Staging Areas

Section 2.6 provides details on the techniques for dewatering dredged material (and the discharge of belt filter pressate), the lime stabilization process, the TC-Lead treatment process, and layouts of the staging areas, in response to the MEPA Certificate and comment letters on the Draft EIR. The section below provides an overview of the sediment dewatering process at the staging areas.

The hydraulically dredged sediment will be dewatered by mechanical methods using belt filter presses or centrifuges. In this method, the sediment is pumped from the dredge through the pipeline to the staging area and into a storage tank. The tank

contains mechanical mixers, which keep the sediments in suspension in the tank. The tank acts as a buffer between dredging and dewatering since the dredge can remove sludge at a higher rate than the dewatering equipment can dewater it. From the storage tank, the sediment will be pumped to the dewatering equipment and may be conditioned with a polymer depending on its dewatering characteristics.

Sediment from the hydraulic dredge will be pumped through a storage tank to provide a feed to the dewatering process. The sediment will be pumped from the storage tank to the belt filter press or centrifuges mounted on 18-wheel flatbed trucks. The dewatered sediment solids will be discharged from a chute on each dewatering unit onto a belt conveyor, which will discharge the solids into dump trailers for hauling and reuse or disposal. If necessary, the product can be stabilized with lime to reduce odor potential, as discussed further in Section 2.6.4. The dewatered sediments will be approximately 22 to 25 percent total solids and contain no free water. This material will pass the paint filter test and will be suitable for hauling in dump trucks or dump trailers.

Some contractors may propose a passive method for dewatering instead of belt filter presses. At Charlesgate, the contractor was approved to use "geotubes." With this method, the sediment is placed in a fabric bag, and the water drains by gravity, which takes about two weeks. A larger storage area is needed for the longer dewatering time. This method is most appropriate for coarse-grained sediments. At Charlesgate, the contractor used grain size distributions and pilot testing to determine that the geotubes were feasible. He also had to demonstrate that the staging area was large enough to keep the schedule from being impacted by the longer dewatering times. In future contracts, the contractor(s) would once again be required to justify passive dewatering operations, including having sufficient space. It is unlikely that this approach could be allowed for the entire operation but may be allowed for small, distinct segments. (Note that while this method was approved for use at Charlesgate, it was not used because the dredging was mechanical rather than hydraulic).

The resulting filtrate from the dewatering process typically is settled in a basin and possibly filtered prior to returning it to the waterway. It will be sampled weekly for total suspended solids (TSS), total and dissolved lead, and dissolved oxygen (DO). In order to be discharged, TSS must be less than 40 mg/l, dissolved lead must be less than 1.0 micrograms/l above the background level, and DO must be 5 mg/l or more. Due to the nature of the dredging and dewatering process, no work can be conducted during extended periods of freezing weather nor during the period March 1 to June 15 to protect fish habitat.

At staging areas servicing Back Bay Fens and The Riverway, both sediment and *Phragmites* will be processed. As described above, the *Phragmites* and other invasive species currently growing in the Back Bay Fens and Riverway will be removed during river dredging. The *Phragmites* will be loaded into barges and then to trucks or directly into trucks.

Dewatered sediment will be loaded onto 18-wheel dump trucks (approximately 20 cy per truck) at a rate of approximately 1 truck per hour.

2.3.5 Sediment Processing and Reuse/Disposal

Section 2.6 provides details on processing and reuse/disposal of dredged sediment, in response to the MEPA Certificate and comment letters on the Draft EIR. The section below provides an overview of these issues.

Sediment reuse/disposal options are dictated primarily by the chemical contaminant levels in the sediment and include disposal at a RCRA landfill, reuse or disposal at an out-of-state landfill, and reuse at an in-state lined or unlined landfill. The sediment from Back Bay Fens and Wards Pond is known to have levels of lead exceeding regulatory limits and, therefore, will require treatment. The treatment for sediments with excessive leachable metals (i.e., lead) consists of binding (immobilizing) them in the sediment into insoluble minerals and mixed mineral forms, rendering the sediment matrix non-hazardous. Treatment of TC-lead sediment on site will be permitted provided that DEP concurs with its use on this project. This process is further described in Section 2.6.6.

The sediment will be reused or disposed of based on DEP reuse criteria and other management requirements (see Section 2.6.7 and Appendix F of the Draft EIR). For purposes of pricing in the Draft EIR, it was assumed that sediment that is chemically suitable for reuse at in-state landfills will be disposed of at out-of-state lined landfills. CDM's experience is that the physical characteristics of the sediment (percent moisture and percentage of fine material) are likely to cause the landfills to reject the material, thereby requiring an alternate disposal site. Therefore, in-state landfills are not considered to be a likely reuse option.

Prior to the shipment of any sediment off site, the following information will be received on each disposal and reuse facility:

General Information

- Facility Name;
- Facility Address;
- Name of Contact Person;
- Name of Emergency Contact Person;
- Titles of Contact Persons;
- Telephone Numbers of Contact Persons;
- EPA Identification Number; and
- Documentation from each facility specifying the volume of sediment that can be accepted from this project on a weekly and total basis.

Written confirmation will be obtained from each facility that it is permitted to accept and would accept the sediment of the general quality and quantity described. The contractor's receiving facility will also state that the facility agrees to submit to the proponent's engineer, by fax, overnight express mail, or by courier delivery within 5 days or receipt of sediment, copies of all facility signed and receipted manifests, and completed and signed bills of lading with certified scale tare and gross weight slips for each load received. The facility will identify the sediment to be accepted and reference the analytical data as the basis of this classification.

The facility will also provide a listing of all permits, licenses, letters of approval, and other authorizations to operate that the facility holds, pertaining to the receipt and management of the sediment.

The contractor will submit the facility's complete list of permitted allowable contaminant levels and physical characteristic requirements for sediment, waste stream documentation and or profile requirements, sampling frequency requirements, and list any required regulatory approval processes that must be followed.

Prior to offsite shipment, the contractor will be responsible for preparing and submitting all waste stream profiles. Proponent's engineer will review the profiles for accuracy and completeness and obtain the owner's signature before the profiles are sent to the facility for approval.

Sediment that is disposed of at a RCRA landfill will be transported under a hazardous waste manifest. The standard EPA 8-copy form will be utilized. The contractor will be responsible for preparing the manifests prior to the shipment date for review by the proponent's engineer.

Sediment that is reused or disposed of at out-of-state landfills or reused at in-state landfills will be transported under a DEP Bill of Lading. BWSC Forms 12A, 12B and 12C will be utilized.

2.3.6 Post-Dredging Activities

Post-dredging activities include stabilization of banks, repair of riprap, mitigation planting (restoration of landscaping), historic treatment, and decommissioning of staging areas.

Once the shorelines are returned to the historic configurations, replanting will take place to stabilize the disturbed areas. The staging areas at Charlesgate, Agassiz and Lagoon will be regraded in accordance with the final grading plan and replanted in accordance with the historic landscaping plan. (Final grading plans will maintain current grades and contours of the staging areas, except at the Fens Bridge where daylighting will occur.) The Fens Bridge staging area will receive temporary stabilization consisting of regrading and hydroseeding to stabilize the area prior to daylighting.

This is consistent with the plan at the Charlesgate staging area, which is expected to be reused during future construction. Final rehabilitation will be according to a revised plan based on public participation and historic considerations.

Additional post-dredging activities are summarized below (see plans in Appendix I of the Draft EIR for specific activities in each area):

- Stabilization of banks after dredging will include plant massing to reflect the Primary and Secondary Periods of Significance.

- The original shoreline, landscape and grading will be restored. The work will include wetland planting, bank planting and upland planting of both shrub and tree layers to improve wildlife habitat and to historically restore the landscape. As described in the Draft EIR, the Olmsted plant lists will be utilized for plant selection.

- Turf-covered banks will include a wetland edge to improve wildlife habitat and lawn on banks and upland to restore the original historic viewsheds.

- The areas from shoreline to edges of paths and areas affected by staging will be loamed and seeded.

2.4 Dredging Summary within Each Geographic Area

Sections 2 and 5 of the Preliminary Design Report (included in the Draft EIR as Appendix I) describe the proposed improvements in detail, including dredging. The following is a summary of the proposed dredging, organized according to the geographic segment of the project.

2.4.1 Back Bay Fens

The flood carrying capacity of the Back Bay Fens will be improved via the dredging and removal of approximately 95,500 cubic yards (cy) — 80,000 cy of accumulated sediment and debris and 15,500 cy of overdredging for three sediment basins.

Hydraulic modeling shows that a channel section 30 feet wide at the bottom with 4 to 1 side slopes and an invert of 2.03 feet BCB reducing to 1.03 feet BCB from the Sears parking lot to Ipswich Street will be required to convey the design flood flows through the Back Bay Fens. This provides sufficient hydraulic capacity for increased flows anticipated from the improvements discussed for the Sears parking lot to the Fens Bridge area. Upstream of the lagoon area, the minimum channel dredging required for flood control is the entire channel. Cross sections in this area are in Preliminary Design Report (Appendix I of the Draft EIR).

Dredging in this section includes completing the partial removal of sediments between Ipswich Street and Boylston Street (Richardson Bridge) started during dredging of the Charlesgate section. *Phragmites* removal between Ipswich Street and Boylston Street would also be conducted as part of the Back Bay Fens work and not part of Charlesgate.

Dredging in the Back Bay Fens area will be conducted using hydraulic dredging equipment and dewatering. Four staging areas are proposed for dewatering equipment in this area. The Charlesgate staging area would be reused for the lower portions of the Back Bay Fens area, if needed. The Agassiz Road staging area may be used for dredging from Ipswich Street to Agassiz Road. A staging area at the Lagoon area would be used for dredging between Agassiz Road and Evans Way along the river. The area upstream of The Fens Bridge at Avenue de Louis Pasteur (site also known as Higginson Circle) would be used for staging dredging downstream to Evans Way.

Closing Agassiz Road between Park Drive and The Fenway will create the Agassiz Road staging area. During construction the contractor will be required to maintain a temporary pedestrian pathway along one side of the site. Access to the river on either side of Agassiz Road closest to the Hemenway Street side could be provided with little loss of existing trees. The access is principally vegetated with *Phragmites* that, once removed, will be replaced with native wetland and emergent plantings.

In addition to dredging sediments along the Back Bay Fens area, invasive species *(Phragmites)* will be removed using mechanical means. The *Phragmites* will be removed using backhoe equipment mounted on barges from the water. Stalks of the *Phragmites* will first be hand cut and removed by barge to the staging areas. The *Phragmites* roots will be excavated using the backhoe and the material taken out through the staging areas. Once the *Phragmites* roots are removed any shore areas disturbed will be refilled and reshaped to the historic shoreline. This will allow a shelf to be reestablished for wetland planting along the water's edge. The areas of *Phragmites* removal are discussed further in Section 5 of the Draft EIR.

Sediment along the Back Bay Fens area varies in quality. Disposal of the sediments will be consistent with the figures in Appendix F of the Draft EIR. In the final design documents, the plans will be delineated consistent with Appendix F, and will direct the contractor to dispose of sediments in the designated disposal categories based on acceptance of the data by the disposal site operators. A total of 95,500 cy of sediment and 23,500 cy of invasive species (root mass) will be removed for disposal or reuse. Approximately 71,750 cy of the material will be disposed of at an out-of-state landfill. Another 47,250 cy of material is considered hazardous material contaminated with lead that exceeds the regulatory leaching potential. The lead-contaminated material will be stabilized through treatment in containers at the staging areas provided that DEP concurs with this approach. Chemical immobilization can be used to stabilize the sediments in order that they can be disposed in an out-of-state lined landfill or reused in state.

2.4.2 The Riverway

The historic capacity of the Riverway will be improved via the dredging and removal of approximately 21,200 cy – 18,500 cy of accumulated sediment and debris and 2,700 cy of overdredging for three sediment basins. Approximately 10,000 cy of invasive species (root mass) will be removed as well.

River cross-sections along The Riverway from the former Sears parking lot up to Leverett Pond have been reduced due to sediment deposition, and the historic capacity of the channel has been reduced. There are three small sections where the capacity is critical for flood control. The remainder currently has sufficient capacity. Restoration of the former cross sections returns these watercourses to their historic capacity and also increases the volume of the water bodies, thereby increasing the amount of aquatic habitat available. Dredging also removes sediment that can be moved downstream, since the improved flood flows will create higher stream velocities. Downstream improvements will result in lower flood elevations in The Riverway.

Dredging and dredge material management discussed in the following sections will be accomplished using hydraulic dredging and dewatering using belt filter presses.

One primary goal of restoring the channel cross section in The Riverway section of the Muddy River is to minimize downstream deposition of the sediments from The Riverway section. Another goal is to remove sediments containing contaminants that affect the benthic community. During the design storm flow velocities in The Riverway vary between 0.2 and 4.2 feet per second (fps). At velocities greater that about 1.0 fps unconsolidated sediments are moved along the river bottom. After improvements are implemented downstream of The Riverway, velocities are expected to increase to between 0.4 and 5.5 fps. The increase is due to the higher downstream capacity that will pass larger storm flows more quickly. By removing sediments to the original channel depths, less sediment can be moved and deposited in downstream dredged areas.

Dredging in The Riverway will lower the invert of the stream from between 6.0 ft. and 4.0 ft. to a new elevation that varies from 3.99 ft. below Route 9 to 3.25 ft. at The Riverway culvert near the former Sears parking lot (all elevations are BCB).

Dredging in The Riverway area will be conducted using hydraulic dredging equipment with mechanical dewatering. One staging area at the Fens at Avenue Louis Pasteur will be used for the dredging between the former Sears parking lot upstream to Brookline Avenue. One staging area at Netherlands Road is proposed for dewatering equipment in this area. All sediments will be pumped to the staging area using flexible piping laid in the riverbed.

Closing Netherlands Road between Parkway Drive and The Riverway will create the Netherlands Road staging area. During construction the contractor will be required to maintain a temporary pedestrian pathway along one side of the site. Access to the river on either side of Netherlands Road adjacent The Riverway can be provided with minimal loss of existing trees (2 to 3). The area to the river will be replaced with historic wetland and emergent plantings once dredging and invasive species removal is completed.

Sediment along The Riverway varies in quality. Disposal of the sediments will be consistent with the figures in Appendix F of the Draft EIR. Approximately 22,600 cy of the material will be disposed at an out-of-state landfill. About 8,600 cy of these

sediments are sufficiently clean to be reused in an in-state landfill, however their physical characteristics (amount of fine materials and water content) appear to warrant out-of-state landfill disposal as well.

Shore areas disturbed by sediment dredging or invasive species removal will be reshaped to the historic shoreline and will include a shelf for planting wetland emergent species. Eroded banks will be restabilized with wetland species.

2.4.3 Leverett Pond

The historic bottom elevations of Leverett Pond will be improved via dredging and removal of approximately 23,900 cy – 21,800 cy of accumulated sediment and 2,100 cy of overdredging for a sediment basin.

The pond cross-section at Leverett Pond has been reduced due to sediment deposition, particularly at the sand bar in front of the Village Brook drain. While the reduction is not sufficient to cause additional flooding, the historic capacity of the pond has been reduced. Restoration of the former cross-sections returns these watercourses to their historic capacity and also increases the volume of the water bodies, thereby increasing the amount of aquatic habitat available. Dredging also removes sediment that can be moved downstream, since the improved flood flows will create higher stream velocities.

Dredging in the Leverett Pond would be conducted using hydraulic dredging equipment and dewatering. The Daisy Field staging area will be used for the dredging in Leverett Pond. Approximately 1.5 ft of sediment will be removed (about 23,900 cy) over most of the pond and more at the sand bar in front of the Village Brook drain.

All sediments will be pumped to the staging area using flexible piping laid in the pond. It is anticipated that all material will be disposed of out-of-state. Approximately 7,200 cy of sediment from this location are sufficiently clean to meet DEP's in-state landfill reuse criteria, however the physical characteristics likely will prevent this.

2.4.4 Willow Pond

The historic pond capacity will be restored by the dredging and removal of approximately 5,900 cy —5,100 cy of accumulated sediment and 800 cy of overdredging for a sediment basin.

The pond cross-section at Willow Pond has been reduced due to sediment deposition. While the reduction is not sufficient to cause additional flooding, the historic capacity of the pond has been reduced. Restoration of the former cross-section returns this watercourse to its historic capacity and also increases the volume of the water bodies thereby increasing the amount of aquatic habitat available. Dredging also removes sediment that can be moved downstream, since the improved flood flows will create higher stream velocities.

Approximately 5,900 cy of sediment (about 6 feet of depth) will be removed from Willow Pond. All sediments will be removed by hydraulic dredging. Willow Pond sediments are contaminated with PAHs and petroleum, mandating disposal in an out-of-state landfill.

The proposed staging area location for Willow Pond dredging is at the Daisy Field between Leverett Pond and the Jamaicaway. Access to the staging area is via Willow Pond Road.

The project will not require temporary roadway, lane, or sidewalk closures along the Jamaicaway or Willow Pond Road. All construction equipment will be staged off the existing travelway.

Staging and traffic management issues are the same as discussed under Leverett Pond.

2.4.5 Ward's Pond

The historic pond capacity of Ward's Pond will be restored by the dredging and removal of approximately 15,600 cy of accumulated sediment and debris.

The pond cross-section at Ward's Pond has been reduced due to sediment deposition. While the reduction is not sufficient to cause additional flooding, the historic capacity of the pond has been reduced. Restoration of the former cross-section returns this watercourse to its historic capacity and also increases the volume of the water bodies thereby increasing the amount of aquatic habitat available. Dredging also removes sediment that can be moved downstream, since the improved flood flows will create higher stream velocities.

Approximately 4 feet of sediment will be removed from Ward's Pond (about 15,600 cy). Sediments will be removed by hydraulic dredging. The pond will be restored to its historic depth to prevent the wetland plant species, which currently inhabit the shoreline, from encroaching into the entire pond.

About 10 percent or 1,500 cy of the Ward's Pond sediment, which contains TCLP lead, will either be stabilized at the Daisy Field staging area, or will be disposed of as hazardous waste as indicated in Appendix F of the Draft EIR. The remainder will be disposed of in an out-of-state landfill. Nearly 12,500 cy of the material are clean enough for reuse in an in-state landfill but the physical characteristics may preclude this.

The proposed staging area location for Ward's Pond dredging is at the Daisy Field between Leverett Pond and the Jamaicaway. Access to the staging area is via Willow Pond Road. The project will not require temporary roadway, lane, or sidewalk closures along the Jamaicaway or Willow Pond Road. All construction equipment will be staged off the existing travelway.

Staging and traffic management issues are the same as discussed under Leverett Pond with the exception of parking. A small parking area off the Chestnut Street side of

Wards Pond will be needed during mobilization and demobilization. The Town of Brookline indicated this temporary loss could be accommodated.

2.4.6 In-Stream Sedimentation Basins

A total of eight-in-stream sedimentation basins (or sumps) are proposed for this project. The basins are proposed in strategic locations to trap sediment discharged with storm water at major outfalls and other areas to slow water velocity to prevent continued sediment transport. The following six basins are proposed at outfalls:

- Back Bay Fens at the Boston Gatehouses (12,500 cy)
- Upper Fens Pond at Avenue Louis Pasteur (Emmanuel College drain overflow, 500 cy)
- The Riverway sections downstream of Netherlands Road (Longwood Avenue drain, 300 cy)
- The Riverway section between Brookline Avenue and The Riverway at Aspinwall Road (Tannery Brook drain, 1,400 cy)
- In Leverett Pond at the Village Brook Drain (2,100 cy)
- In Willow Pond at the Chestnut Street drain (800 cy)

These are major drainage system outfalls that have the capacity to discharge sediment loads to the river as evidenced by the extensive sediment deposits at the Boston Gate Houses and Village Brook Drain outfalls. Although structural and non-structural BMPs will reduce sediment loads significantly, some sediment is expected to continue to be deposited in the river at storm drain outfalls. Providing basins at these locations will trap sediment and prevent it from continuing to migrate along the river channel.

The other two basins are located at the:

- The Riverway section near the Back Bay Yard at the culvert inlet (1,000 cy)
- Back Bay Fens downstream of the Duck House (2,500 cy).

The sediment basin near the Back Bay Yard is proposed to trap sediment before it enters the culverts that convey flow under the roadway network at the Riverway and Park Drive connector. The culverts and proposed open channel flow sections downstream of the culverts are narrow river sections that will convey flow at a higher velocity than the wider Back Bay Fens areas. Therefore, this basin is proposed to trap sediment at this location so it does not remain suspended, only to be deposited at the Back Bay Fens.

The sediment basin at the Duck House is proposed just upstream of where the river widens at the Victory Gardens. This basin is proposed to collect sediments before the wider river section reduces velocities further and induces more settlement.

The project includes the development and implementation of a watershed BMP plan to reduce the sediment load to the river from the tributary area. The watershed BMP plan is more fully discussed in Section 5 of this document. This plan will be implemented and will decrease the volume of sediment conveyed to the river compared to historic and existing sediment loadings. However, sediment will continue to be conveyed to the river with urban runoff. The in-stream basins will serve as the last BMP in the proposed "treatment train" to reduce the transport of sediment throughout the river channel (see Section 3.4 for more detail).

2.5 Impacts and Mitigation Measures

2.5.1 Introduction

The proposed dredging will result in the temporary disturbance of the Muddy River and public use of portions of the parklands, roadways, and pedestrian walkways. Specifically, staging areas for dredging and other activities will contain some combination of sedimentation tanks, pumps, coagulant polymer feed systems, belt filter presses, water filters, conveyor belts for truck loading, a field office, and/or limited construction parking.

Specific impacts related to dredging and dredged material management are summarized below.

2.5.2 Sediment Quality

Muddy River sediment consists of organic silt, fine-to-coarse sand, and gravel. At various locations along the river the sediment also contains cobbles and boulders, decayed plant matter, sticks, peat, bricks, wood glass, and pieces of concrete. Contaminated sediments will be handled according to state and federal laws and regulations. Accumulated sediments will be removed to depths ranging from one to five feet. This removal will increase river flow capacity and improve overall sediment quality.

2.5.3 Water Quality

Construction activities will temporarily affect the Muddy River's water quality. Runoff from the staging areas, dredging operations, and return water from the belt filter presses will tend to increase turbidity in the river. The durations will be short, and due to the extremely low flow volume of the Muddy River, the area affected will be limited. The return water will be treated so that total suspended solids (TSS) are less than 40 mg/l, dissolved lead is less than 1.0 micrograms/l, and the dissolved oxygen level is at least 5 mg/l.

2.5.4 Benthic Resources

Dredging will result in a temporary loss of benthic species (e.g., worms, midges and other invertebrates), which are presently dominated by pollution-tolerant organisms. Some remaining benthic species are expected to act as seed for regrowth. However, the new community is likely to be less dominated by pollution-tolerant organisms as clean water benthic species begin to proliferate.

2.5.5 Fish Resources

It is anticipated that dredging will kill some fish. The fish loss may be proportionally higher in the bottom-dwelling species than the open-water species (the Muddy River would actually benefit from substantially fewer bottom-dwelling species). Silt curtains will be installed at each end of the river segment to be dredged. Prior to dredging, fish will be netted and released ether upstream or downstream of the segment. Because Spring Pond contains a rare fish species, the three-spine stickleback, no construction work will directly affect Spring Pond. The stickleback has also been found in a small pool in Willow Pond where the water from Spring Pond falls below a small stone dam. Sticklebacks in this pool will be temporarily relocated, and the Willow Pond pool will be protected during dredging in the pond. See Section 9 for further discussion on impacts and mitigation for the sticklebacks.

2.5.6 Wetlands

The proposed work includes the removal of *Phragmites*, including the extensive root systems. Where one species dominates the present ecosystem, several species of shoreline and emergent plans will replace it. This will result in a substantial enhancement of the functions and values of the aquatic, wetland, and upland ecosystems as well as a commensurate enhancement in wildlife functions and values. The proposed project will result in "no net loss" of wetland resources.

2.5.7 Wildlife Resources

In locations where dredging occurs during winter hibernation, amphibians and reptiles that are not relocated will be lost. The contractor will be required to relocate wildlife from within the work zone to suitable areas outside of it. After construction, the upland wildlife community will benefit significantly from the revegetated landscape that will feature a diverse plant selection based on the Olmsted plant list and eliminating species known to be invasive.

2.5.8 Ecological Functions and Values

Dredging will temporarily impact the current habitat's function and values. Long-term physical alterations are related to bank stabilization, deepening of the water body, reconstruction of an island, and the enhancement of the aquatic and upland ecosystems to more natural ecosystems.

The project construction as a whole, including dredging and dredged material management, will also affect pedestrian access and traffic, and generate noise.

2.5.9 Mitigation

Mitigation of construction-related impacts, including dredging and dredged material management, will be implemented in two ways:

- Contract documents will include specifications with requirements that the contractor must meet to reduce environmental impacts; and

- The contractor will prepare plans, for approval by Engineer, on the dredging operation, disposal of materials, and the methods by which the contractor will control impacts of the dredging operations.

A Resident Engineer and an Independent Environmental Monitor will monitor compliance with the contract documents and contractor's submitted plans.

2.6 Responses to Comments on the Draft EIR

2.6.1 Introduction

Secretary Durand, in the Certificate on the Draft EIR states "The Final EIR should provide more details on the dewatering process and sediment management in general. DEP has made a number of comments covering sediment sampling and management protocols. The Final EIR should address those issues."

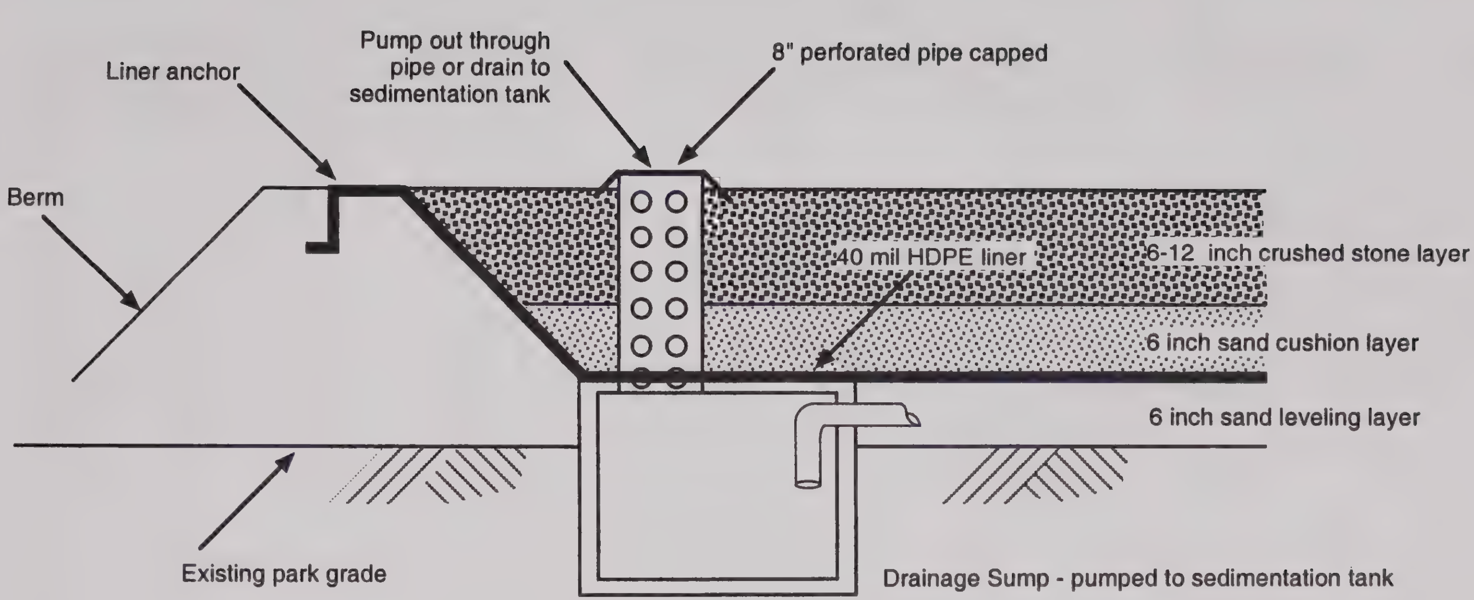
The DEP letter on the Draft EIR is included in Appendix B. The Final EIR response to comments section, which provides responses to each of DEP's comments, as well as the other comment letters, is included in Section 12. The remainder of this section addresses the MEPA Certificate on the Draft EIR and the DEP issues.

2.6.2 Staging Area Protection and Sampling

Six staging areas were proposed in the Draft EIR for use by the contractor during construction. The principal activities in the staging areas will be dewatering and loading out of the dewatered sediments for disposal or reuse. Two staging areas (Agassiz Road and Lagoon Area) are expected to be used by the contractor to process sediments that failed the TC-lead test procedure and will be stabilized in containers before shipment to disposal or reuse locations. This may also occur at Daisy field for the dredging of a very small segment of Wards Pond.

In order to address the potential for spills during handling of the TC-lead contaminated sediment and also to address potential alternate dewatering process similar to that proposed for the Charlesgate dredging, all the staging areas will be lined prior to use. A lining system will prevent possible contamination of the existing park land.

Staging areas or portions of staging areas proposed by the contractor to be used for dewatering and processing sediments will be prepared with a high density polyethylene (HDPE) liner. A bermed liner will be placed on a 6-inch sand leveling layer. The liner will be 40 mil HDPE liner material with a 6-inch sand cushion layer followed by 6 to 12 inches of crushed stone as a working base for the dewatering area. The bermed liner will prevent runoff from the staging area being discharged directly to the parkland. The staging area will be provided with a sump to collect runoff and rainwater and will be pumped through a sedimentation tank before discharge to the river. If there is a spill in the staging area the collected runoff will be tested prior to discharge to the sedimentation tank. A typical cross section of the staging area liner and sump is shown on Figure 2-1.



Staging Area Liner Cross Section (including drainage sump)

CDM

Figure 2-1
Staging Area Liner

Equipment used for TC-Lead sediments will be decontaminated. This will be part of the demobilization phase of the construction. The requirements for decontamination will be spelled out in the specifications.

Once the contractor has completed work in the staging area, the gravel and sand above the liner will be tested and appropriately disposed of. The liner will be steam cleaned and disposed of as solid waste. The sand leveling layer under the liner will be tested in 5 locations for TPH, PAH and RCRA metals. If contamination levels do not exceed those suitable for park use then the sand will be reused as appropriate and the parkland restored to its original condition. If the sand layer is found to be contaminated, the material will be disposed of at an appropriate landfill and the park surface under the sand layer will also be tested for the compounds of concern and a suitable cleanup plan supervised by a licensed site professional will be initiated.

The turf will be aerated when the staging areas are restored to their former condition. This requirement will be included in the specifications. (At Charlesgate, the staging area will be temporarily mulched or loamed and seeded, which will not require aeration. When the dredging is complete, the Phase 2 restoration of Charlesgate will begin, and the soil will be aerated as necessary. Note that this area will be available for staging during dredging of both Charlesgate and the rest of the project.)

2.6.3 Management of Belt Filter Pressate and Odor Control Foam

Pressate from belt press dewatering (or drainage from geotubes) will be collected and pumped to a sedimentation tank prior to discharge back to the river. The contractor will be responsible for meeting water quality conditions of the Water Quality Certificate. In order to discharge to the river the discharge must contain total suspended solids of less than 40 mg/l, dissolved lead of less than 1.0 microgram/l above the background level, and dissolved oxygen of at least 5.0 mg/l.

Discharge will be analyzed once per week and the contractor will be required to increase engineering controls if the limits are not met. These controls could be increasing the size of the sedimentation tank, adding filtration, or adding polymer to improve solid removal. Discharge from the sedimentation system will be within a silt curtain in the river.

If lime is used for odor control in the sediments, pH of the pressate will be tested. The contractor will be required to reduce the pH of the pressate to between seven (7) and nine (9) before discharging back to the river.

One of DEP's concerns was the aquatic "polymer toxicity" from backdraining of the belt-filter pressate. The potential adverse ecological effects associated with the use of two products, the Callaway 4400 series polymer dewatering product and the AC-645 Long Duration Foam, were reviewed in response to this concern for toxicity. Both products could be used during dewatering of Muddy River sediments.

The Callaway 4400 product is an example of a polymer that may be used as a dewatering agent to dewater the sediments removed from the Muddy River. Very

little ecological information was available from the material safety data sheet (MSDS) obtained from Vulcan Performance Chemicals. Acute toxicity tests were performed on freshwater crustaceans (*Ceriodaphnia dubia*) and fathead minnows (*Pimephales promelas*). Results indicated a LC_{50} (Lethal Concentration 50 – concentration at which 50% of the exposed organisms die) of 37.9 mg/L for a 48 hour exposure for the freshwater crustaceans and 1.07 mg/L for a 96 hour exposure for the fathead minnow.

The primary constituents of the Callaway 4400 series include petroleum distillates and adipic acid. Below is a summary of the potential adverse ecological effects for each of these constituents. The toxicity information was obtained from the Hazardous Substance Database (HDSB), an online database provided by the National Library of Medicine.

<u>Adipic Acid</u> - According to environmental fate and exposure information provided in the HSDB, if adipic acid is released into water it is not expected to adsorb to suspended solids and sediments in the water column and the potential for bioconcentration in aquatic organisms is low. Biodegradation is likely to occur. In a river die-away test, 90% of the adipic acid degraded within 7 days. In addition, volatilization from water surfaces is not expected to be an important fate process.

<u>Petroleum Distillates</u> - Petroleum distillates is a broad category of chemicals that encompasses a large mixture of hydrocarbon compounds. Therefore, only a general discussion of potential toxicological effects to the aquatic environment can be presented. According to environmental fate and exposure information provided in the HSDB, if petroleum ether/distillates are released into water, volatilization will be rapid (2.5 hours to 2.7 hours from a model environmental river) and bioconcentration in aquatic organisms may not be an important fate process.

Also evaluated was AC-645, a foam barrier used to control dust, odors and volatile organic compounds (VOCs) during active excavation activities at hazardous waste sites. According to information provided by RUSMAR Foam Technology, in its foamed state, AC-645 is 95% air. Of the remaining 5%, 90% is water and 10% is solids. AC-645 is biodegradable.

The primary constituents of the AC-645 Long Duration Foam include alpha olefin sulfonate, triethanolamine stearate, potassium polyacrylate, and potassium phosphate. Very little ecological information is available for these individual constituents. Below is a summary of the potential adverse ecological effects (if any) available for each of the constituents. The toxicity information was obtained from RUSMAR Foam Technology and various material safety data sheets.

Alpha olefin sulfonate – Complete biodegradation (100%) occurred in less than 10 days (die-away test)

Triethanolamine stearate – No ecological information is available.

Potassium polyacrylate – No ecological information is available.

Potassium phosphate – Potassium phosphate is not biodegradable.

Based on the available ecological data, it can be concluded that both the Callaway 4400 dewatering agent and the AC-645 odor suppressing agent can be used in dewatering Muddy River sediments without adverse ecological effects to the river.

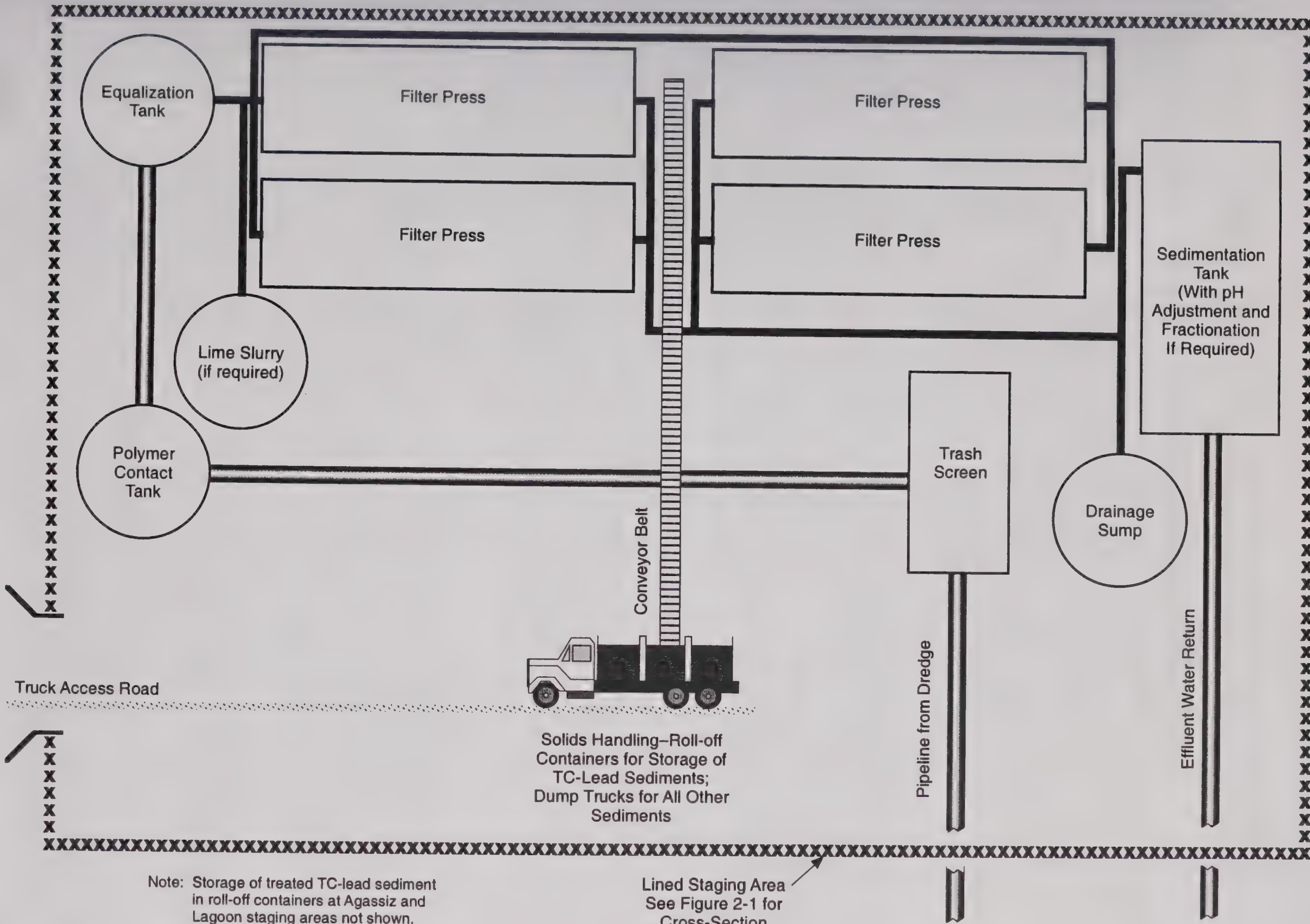
2.6.4 Lime Stabilization of Sediment and Odor Control

Regardless of the staging locations and method of dewatering, lime stabilization will be used as needed to deal with sulfide reactivity and odor control. (This will be in conjunction with the use of foam and tarps for odor control.) The contractor will be required to have the necessary equipment on site at all times. The lime will be delivered in pneumatic bulk carriers, or in bags if quantities are small, and stored in fully enclosed containers to prevent generation of dust. The lime slurry will be prepared in a batch plant and mixed with the sediment at the head of the belt filter press (or geotubes, if used). The lime stabilization equipment will occupy an area 20-feet by 20-feet as shown in the staging area schematic in Figure 2-2. An alternative will be allowed whereby the contractor prepares the lime slurry off site and delivers it to the work area. The contractor may also use enclosures over the dewatering operations or tarps over the geotubes (if used) to control odors on site. In addition, the contractor will be required to have odor control foam available on site at all times (e.g., AC-645 as described in Section 2.6.3). Foams are effective in preventing off-gases originating from stockpiles, containers, or exposed sediments and will be used if the situation requires.

2.6.5 Post-Dewatering Sampling

There were several comments regarding the need for post-dredging/dewatering sampling. CDM has identified three facilities that can accept the dewatered material based on the in-situ sampling ("characterization") and the opinion of an LSP regarding the adequacy of the testing program ("classification"). (Telephone call reports to these facilities are contained in Appendix F, Attachment F-1 of the DEIR.) A preliminary review by CDM's LSP determined that sufficient sampling has been conducted and that the in-situ data are representative of the dewatered material. The contractor will be expected to provide a similar opinion to allow reuse/disposal facilities to accept material based on the in-situ sampling results. The contractor would then propose the use of these facilities, subject to approval by the engineer. This is the preferred alternative for sediment management, other than for TC-Lead treatment.

If "unusual" materials are encountered and identified by on-site staff or if the reuse/disposal facilities proposed by the contractor require additional sampling, then the sediments would have to be stored on site in roll-off containers, as the TC-Lead sediments are being handled. The contractor will have to provide for these contingencies. If "unusual" materials are present, then they were not identified during the in-situ sampling and are likely to occur in relatively small, isolated areas. Assuming that the dewatering operation requires 30,000 sf, then each of the proposed staging areas, except for Netherlands Road, has excess capacity for post-dewatering sampling and storage. (The Agassiz area is proposed to be used in conjunction with



Note: Storage of treated TC-lead sediment in roll-off containers at Agassiz and Lagoon staging areas not shown. Refer to Figure 2-3.

CDM

Figure 2-2
Schematic of Staging Area

the Lagoon area for TC-lead sediments and post-dewatering sampling will be conducted.) Additional area will be available at the Charlesgate staging area.

2.6.6 TC-Lead Treatment and Staging Area Layouts

The preferred alternative for the handling of TC-Lead sediment in the Back Bay Fens is to use two staging areas, subject to DEP approval. This would allow a production rate of 400 cy per day to be achieved. Dewatering would take place at Agassiz Road. The sediment would be treated either during dewatering or as it is loaded into roll-off containers following dewatering. The treatment would convert leachable lead into insoluble minerals and mixed mineral forms and render the sediment matrix non-hazardous. The containers would be trucked to the Lagoon staging area, unloaded, sampled, stored pending receipt of the sampling results from the laboratory, and trucked off site for reuse or disposal.

The containers would be trucked between the two areas along a 600-foot section of Park Drive. Trucks leaving the Agassiz area would make a left-hand turn onto Park Drive and a left-hand turn into the Lagoon area. Park Drive is a one-way road, and traffic disruptions would be minimal. Trucks would return by Park Drive to Boylston Street to Park Drive. The trucks and containers would be washed down before leaving the Agassiz area. The containers would be covered during transport to the Lagoon area and easily trucked between site locations.

An alternative approach would be to use both staging areas, with both dewatering and storage operations taking place at each one. This is shown on Figure 2-3. This alternative would eliminate the need to transport the roll-off containers for storage. It would achieve a lower production rate of 370 cy per day (100 cy per day at Agassiz and 270 cy per day at Lagoon) because additional space would be required for the second dewatering facility at Agassiz. The lower production rate could extend the schedule for this part of the project, and the second dewatering facility would increase the cost.

The schedule presented in the Draft EIR is based on a production rate of 400 cy per day. The preferred alternative for handling TC-Lead sediments, described above, can meet that schedule. Other alternatives that may be proposed by the regulatory agencies, contractors, or other parties could extend the schedule for this part of the project. For instance, the use of "geotubes" for dewatering would limit production to 130 cy per day. The engineer would approve this method only if the contractor could show that the schedule would not be adversely impacted.

TC-lead sediments from Wards Pond will treated similarly at Daisy Field. However, space is not expected to be a constraint. The quantity of TC-lead sediment is small, about 1,500 cy, and the area of Daisy Field 45,000 sf.

2.6.7 Ultimate Sediment Reuse or Disposal

There are four reuse/disposal options and one treatment option for the sediment after dredging and mechanical dewatering are completed. The reuse/disposal options are dictated primarily by the chemical contaminant levels in the sediment and include

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Figure 2-3
Staging Areas for TC-Lead Sediment

disposal at a RCRA landfill, reuse or disposal at an out-of-state landfill, reuse at an in-state lined landfill, and reuse at an in-state unlined landfill. The treatment option consists of binding (immobilizing) certain chemical contaminants (i.e., metals) in the sediment into insoluble minerals and mixed mineral forms, rendering the sediment matrix non-hazardous.

Disposal of the sediment at RCRA landfills will be required when the chemical contaminant levels exceed RCRA characteristic and listed waste thresholds defined in 40 CFR 261 and cannot be a TSCA waste as defined in 40 CFR 761.

Disposal or reuse of the sediment at an out-of-state landfill(s) will be required when the chemical contaminant levels exceed the in-state reuse criteria and DEP does not approve their reuse in-state, as provided in Policy No. COMM-97-001, or when the physical properties of the sediment make it unsuitable for reuse or the market demand for reuse materials is low. However, chemical contaminant levels in the sediment cannot exceed RCRA characteristic and listed waste thresholds in 40 CFR 261 and cannot be a TSCA waste as defined in 40 CFR 761.

Reuse of the sediment at in-state lined and unlined landfills can occur with no specific DEP review or approval when chemical contaminant levels are below the following criteria listed in Policy No. COMM-97-001:

Contaminant	***Lined Landfill (mg/kg)***	***Unlined Landfill (mg/kg)***
Total Arsenic	40	40
Total Cadmium	80	30
Total Chromium	1,000	1,000
Total Lead	2,000	1,000
Total Mercury	10	10
TPH	5,000	2,500
Total PCBs	<2	<2
Total SVOCs	100	100
Total VOCs	10	4
Conductivity	8,000 umhos/cm	4,000 umhos/cm
Listed or Characteristic Hazardous Waste	None	None

When contaminant levels exceed these criteria, then DEP review and approval is required for reuse of the sediments.

Treatment of TC-lead sediment on site will be permitted provided that DEP concurs with its use on this project (see Section 2.6.6). Treatment will occur either during the mechanical dewatering process or during loading into roll-off box containers. In either case, the sediment will be stored in roll-off box containers in secure areas under lock and key. Roll-off box containers will not be removed until test results are received to confirm that the process has rendered the sediment non-hazardous. Proposed confirmatory sampling will include one sample per roll-off box composited up to 100 cubic yards. Disposal and reuse of the sediment following treatment will be at an out-of-state landfill and in-state lined and unlined landfills, as dictated by the

other chemical levels (i.e., total metals, petroleum, PCBs), physical characteristics, and market conditions, as noted above.

For purposes of pricing in the Draft EIR, it was assumed that sediment that is chemically suitable for reuse at in-state landfills will be disposed of at out-of-state lined landfills. CDM's experience is that the physical characteristics of the sediment (percent moisture and percentage of fine material) are likely to cause the landfills to reject the material, thereby requiring an alternate disposal site. Therefore, in-state landfills are not considered to be a likely reuse option.

3

Section Three

Section 3
Wetland and Water Quality Impacts and Mitigation for Preferred Dredging Alternative

3.1 Introduction

This section addresses impacts of the preferred dredging project on wetlands and water quality (including wildlife and benthic habitat) and measures to monitor and mitigate those impacts during construction.

Section 3.2 provides an overview of the relevant MEPA Certificate and Draft EIR comments; Section 3.3 summarizes the extent of the wetland impacts in each geographic area; Section 3.4 addresses water and sediment quality; and Section 3.5 describes water quality issues during dredging operations.

3.2 MEPA Certificate and Draft EIR Comments

Both MEPA and DEP requested that more information be provided in the Final EIR regarding the wetland and water quality impacts of the proposed project. Specific issues or comments relative to wetlands and water quality are presented below:

- Include more detail (quantitative and qualitative) on alteration and replication of bordering vegetated wetland (BVW), including areas of permanent loss and areas of replication, as well as areas of wetland resource increases;
- Provide more detail on specifics of *Phragmites* removal and replication design;
- Include an analysis of whether any other invasive species will be removed and methods of removal;
- Describe the type of soil to be used on the shelves and how the shelves will be stabilized prior to establishment of wetland plants;
- Address the potential negative biological impacts of in-stream basins;
- Analyze the potential for anoxic conditions to develop in areas of overdredging and potential impacts on water quality and benthic habitat;
- Analyze impacts from periodic maintenance dredging on water quality and benthic habitat;
- Develop site-specific approach to defining mixing zones;
- Discuss suspended solids limit and how the background is defined (DEP prefers real-time measurements);

- Outline corrective actions for water quality exceedances and criteria for defining exceedances;
- Allowable TSS or turbidity to be returned to the river should be linked to the reference location TSS or turbidity;
- Include more discussion of construction period water quality performance standards and identify action thresholds;
- Individuals hired to capture and release Three-Spine Sticklebacks will need appropriate certifications/licenses; and
- Capture and release any fish or amphibians impounded within the work areas.

3.3 Extent of Wetland Loss and Replacement

3.3.1 Summary of Wetland Impacts in Back Bay Fens

Work in the Back Bay Fens involves work within Land Under Water, Inland Bank, BVW, Land Subject to Flooding and Riverfront Area, as well as the 100-foot buffer zone to Inland Bank and/or BVW. The extent and location of these activities is described below in Section 3.3.5. The majority of work (i.e. area of alteration) involves dredging Land Under Water to remove accumulated sediment and *Phragmites* to eradicate *Phragmites* growing within the river channel, and limited alteration of BVW and Inland Bank for restoration of riparian plantings along the river. As documented in the Draft EIR, these activities will occur within approximately 16.2 acres of Land Under Water, 0.4 acres of BVW and along 13,540 linear feet of Inland Bank.

The extent of Land Under Water and Inland Bank present in the Muddy River corridor will increase as a result of "daylighting" the Muddy River at Avenue Louis Pasteur and the former Sears Parking Lot. This work will result in an additional 1,805 linear feet of Inland Bank and 0.99 acres of Land Under Waterway. The proposed planting list includes wetland indicator plants that can be used to revegetate the shoreline of these two areas thus increasing the area of BVW in the Back Bay Fens. The grading and planting plan is not complete to date, however, so no increase in the area BVW is presented in this Final EIR. Please note, wetlands can be established on the banks in these two areas resulting in a net increase of BVW. See Sheets 1 through 34 at the end of this section for the proposed planting plans.

3.3.2 Summary of Wetland Impacts in the Riverway

Work in the Riverway involves work within Land Under Water, Inland Bank, BVW, Land Subject to Flooding and Riverfront Area, as well as the 100-foot buffer zone to Inland Bank and/or BVW. The extent and location of these activities is described below in Section 3.3.5. The majority of work (i.e. area of alteration) involves dredging Land Under Water to remove accumulated sediment and to eradicate *Phragmites* growing within the river channel. Limited alteration of BVW and Inland Bank for restoration of riparian plantings along the river is also proposed. As documented in

the Draft EIR, these activities will occur within approximately 9.4 acres of Land Under Water, 0.7 acres of BVW and along 12,670 linear feet of Inland Bank.

Channel dredging will remove *Phragmites* located with the river channel to restore flood flow capacity at locations where its growth impedes flow. Bank to bank dredging is proposed to eradicate this plant from the river corridor. Dredging will not increase the extent of Land Under Water in this river segment. The proposed project will alter the existing character of the Inland Bank in the Riverway, but will not result in any change in bank length. Work on the Inland Bank will involve re-grading the bank to transition the new channel to adjacent uplands, and restoration of Olmsted plantings along the shoreline. The planting will increase structural and plant species diversity of the banks which correlates to improved wildlife habitat of the Muddy River shoreline. Although final grading of the channel is not completed to date, the grading is predicted to result in a net loss of 0.1 acre of BVW along the Riverway. Where the BVW is comprised of *Phragmites* or other non-native species, the plant community will be restored to a native community using Olmsted plan plant species. This will alter the plant community but not result in a loss of BVW.

3.3.3 Wetland Functions and Values

Wetland functions and values were evaluated and presented in the Draft EIR. That evaluation utilized the methodology described in the Army Corps of Engineers New England District booklet entitled <u>The Highway Methodology Workbook Supplement, Wetlands Functions and Values a Descriptive Approach</u> (USACE, 1995). The Corps' method is a systematic presentation of best professional judgment with backup information to support the conclusions. It involves reviewing a number of parameters for each function or value to assess the ability of the wetland to perform that particular function or support that value. It involves reviewing a combination of field data and published data, to complete a questionnaire. Based on the responses to the questionnaire, one summarizes the results for each wetland to assess the suitability of a wetland to perform the identified functions and values. A summary of the functions and values assessment prepared for the Draft EIR is presented below in Table 3-1.

Wetland systems are likely to support most functions or values to a certain degree, but it is important to identify those functions and values that are most important or most strongly supported by a particular system, (i.e. Principal Function/Value). A review of Table 3-1 identifies that a number of functions or values are likely to occur in the Muddy River system (identified as "occurrence"), however, only a small subset are identified as a Principal Function/Value. Table 3-2 presents a comparison of ACOE functions/values to the Interest of the Wetlands Protection Act. The principal functions/values for the major river segments are:

- ***Back Bay Fens Victory Garden***

Flood Flow Alteration, Sediment & Toxicant Retention, and Nutrient Removal

Table 3-1

Summary of Wetlands Functions and Values

Location	Status	Groundwater Recharge/Discharge	Flood Flow Alteration	Fish & Shellfish Habitat	Sediment & Toxicant Retention	Nutrient Remval	Production Export	Sediment/Shoreline Stabilization	Wildlife Habitat	Recreation	Educational Scientific Value	Uniqueness/Heritage	Visual Quality/Aesthetics	Endangered Species Habitat
Back Bay Fens Victory Garden														
	Occurrence	N	Y	Y	Y	Y	N	Y	N	Y	N	N	N	N
	Principal Function/Value		**Y**		**Y**	**Y**								
Riverway Area														
	Occurrence	N	Y	Y	Y	Y	N	Y	N	Y	N	N	N	N
	Principal Function/Value		**Y**		**Y**	**Y**								
Leverett Pond														
	Occurrence	N	N	Y	N	N	N	Y	N	Y	N	N	N	N
	Principal Function/Value			**Y**						**Y**				
Willow Pond														
	Occurrence	N	N	Y	N	N	N	Y	N	Y	N	N	N	Y
	Principal Function/Value			**Y**						**Y**				**Y**
Wards Pond														
	Occurrence	Y	N	Y	N	Y	Y	Y	Y	Y	N	N	Y	N
	Principal Function/Value								**Y**	**Y**				

- ***Riverway Area***

Flood Flow Alteration, Sediment & Toxicant Retention, and Nutrient Removal

- ***Leverett Pond***

Fish Habitat, Recreation

- ***Willow Pond***

Fish Habitat, Recreation and Endangered Species Habitat

- ***Wards Pond***

Wildlife Habitat and Recreation.

Table 3-2

Comparison of Wetland Protection Act Interests to ACOE Functions and Values

Wetland Protection Act Interest	*ACOE Functions and Values*
Protection of public or private water supply	Groundwater Recharge/Discharge
Protection of groundwater supply	Sediment and Toxicant Retention, Groundwater Recharge/Discharge
Flood control	Flood Flow Alteration
Storm damage prevention	
Prevention of Pollution	Sediment and Toxicant Retention, Nutrient Removal, Sediment Stabilization
Protection of land containing shellfish	Fish and Shellfish Habitat, Endangered Species Habitat
Protection of fisheries	Fish and Shellfish Habitat, Endangered Species Habitat
Protection of wildlife habitat	Wildlife Habitat, Endangered Species Habitat

In the Back Bay Fens and Riverway segments the principal functions are directly related the river's bathymetry and the dense stands of *Phragmites* present within those river segments. In these river segments, water velocity is very sluggish resulting in a long residence time, which contribute to the retention of sediment and toxicants, and nutrient removal functions. These functions are further enhanced by the presence of dense *Phragmites* stands present in these areas, which serve to trap sediment and take up nutrients. Flood flow alteration is a principal function in these areas because there is significant area for flood storage within the river corridor.

Although not identified as a function, the river and *Phragmites* stands in the Fens do provide limited wildlife habitat in this urban setting. The function and values assessment presented in the Draft EIR that these areas do not provide wildlife habitat because only a small number of parameters applicable to wildlife habitat are present in the Back bay Fens and Riverway segments. However, in context with surrounding urban environment the river and adjacent parkland support birds and small mammals adapted to living in urban environments, because it presents the only naturalized areas within this urban landscape. Although not a principal function, these river segments do provide limited habitat to aquatic invertebrates, fish, birds, and reptiles the presence of which was documented in the Draft EIR.

The Riverway is a narrow band of parkland along the river bound by roadways (parkways), trolley tracks and dense development. The primary wetland areas are the river and riverbanks. The banks are mixture of grass slopes, exposed soils with shrub masses dotting the shoreline and trees scattered throughout the adjacent park land. The habitat characteristics of the river and adjacent riparian zone were not documented to provide significant wildlife habitat functions as presented in Table 3-1.

Leverett Pond and Willow Pond provide fisheries habitat function and recreation values. The presence of Three Spine Stickleback in Spring Pond and immediately below the dam in Willow Pond adds additional value to this resource area. The extent of wetlands around the perimeter of these ponds and along the river between the ponds is limited to a narrow band of vegetation along the banks of the ponds and river. Therefore, the principal "wetland" functions and values are those functions/values associated with the water bodies and waterway, because the narrow fringe of wetland vegetation itself provides little opportunity to support the various functions/values.

The most upgradient pond, Wards Pond is documented to provide wildlife habitat and recreation. Although the extent of wetland vegetation bordering this pond is more expansive compared to the downgradient ponds, the principal function are mostly correlated to the pond than to the wetland plant community. A densely developed urban residential area surrounds these three ponds and the surrounding parks and naturalized areas. This juxtaposition of a naturalized landscape within the urban landscape provides upland habitat for birds and small mammals for which the ponds and river provide an important water source.

3.3.4 Phragmites Functions and Values

Common reed (*Phragmites australis)* is a tall perennial rhizomatous grass. Common reed has a world wide distribution as it is found on every continent except Antarctica. Common reed produces a large number of seeds per plant and also spreads vegatatively by a vigorous system of rhizomes and stolons. These reproductive strategies causes common reed to be an invasive plant forming dense stands of monospecific communities. Since common reed is invasive, there is some debate over whether it is native to this area. There is some evidence that common reed is

indigenous to North America. Common reed was identified in cores of 3000 year old peat from tidal marshes in Connecticut and common reed remains dating from 600 to 900 A.D. were found during archaeological investigations in southwestern Colorado (see review by Lapin and Randall, 1993). It has been considered a nuisance plant in the U.S. since the 1940's, and because of that there has been some discussion that a non-native strain of common reed may have been introduced from Europe in the early 1900s. The invasive growth form may be associated with this exotic type (Cronk and Fennessy, 2001).

Common reed typically inhabits freshwater and brackish wetlands throughout our area. It occurs in disturbed areas as well as pristine sites forming near-specific stands by out competing other plants. Human disturbance of sites may promote its growth. Increases in common reed are also thought to be promoted from increases in soil salinity from road deicing salts, increases in nutrient concentrations (in particular nitrates), alteration of natural hydrologic regimes, and dredging.

Common reed becomes established through dispersal of seeds or pieces of viable stems called rhizomes. Established stands grow mainly from sending up new shoots each spring from existing rhizomes, or from aboveground runners called stolons. The plants flower and set seed generally between July and September. In our area, seeds are dispersed between November and January by wind or via birds that nest in the reeds. Human disturbance may favor common reed seed establishment. During a construction activity in and around wetlands, sixty-nine (69) rhizome buds were removed from the treads of a tracked vehicle working in a common reed dominated community (M.S. Ailstock, *et al.*, 2001).

Wetland functions are self-sustaining properties of a wetland ecosystem and include all the processes necessary for the self maintenance of the wetland ecosystem such as production and nutrient cycling. Wetland values are based on the societal values of these wetland functions. The Army Corps of Engineers recognizes the following thirteen (13) wetland functions and values: Groundwater Recharge/Discharge, Floodflow Alteration, Fish and Shellfish Habitat, Sediment/Toxicant/Pathogen Retention, Nutrient Removal/Retention/ Transformation, Production Export, Sediment/Shoreline Stabilization, Wildlife Habitat, Recreation, Educational/Scientific Value/Uniqueness/Heritage, Visual Quality/Aesthetics, and Threatened or Endangered Species Habitat.

A literature review was conducted to identify the wetland functions and values of common reed dominated wetland plant communities. The following four functions/values were found to be associated with common reed dominated wetlands:

- Sediment/Toxicant Retention,
- Wildlife Habitat,

- Sediment/Shoreline Stabilization, and
- Nutrient Removal/Retention/Transformation.

Sediment/Toxicant Retention – This function reduces or prevents degradation of water quality. It relates to the effectiveness of the wetland as a trap for sediments, toxicants, or pathogens.

Studies have found that *Phragmites australis* can be an important soil stabilizer and may have an application as a nutrient sink for treating wastewater prior to release (Ailstock, *et al.*, 2001). *Phragmites australis* is commonly used for sediment trapping in subsurface flow wetlands in Europe (Cronk and Fennessy, 2001), however its invasive characteristics prevents its use in this fashion in North America. The dense stands of persistent stalks also aid in the trapping of sediment carried in water flowing through reed stands.

Wildlife Habitat – This function considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and the wetland edge. Both resident and/or migrating species are considered.

The literature is inconclusive on the wildlife habitat functions provided by *Phragmites* marshes. Therefore, the ability of an individual Phragmites marsh to support this function should be evaluated on a case-by-case basis. The wildlife habitat of near mono-specific stands of common reed is commonly considered of little value by North American biologists. The U.S. Fish and Wildlife Service describes common reed as being high quality livestock forage during early growth stages but after maturity it becomes tough and unpalatable and is not an important wildlife food. Occasionally however seeds are eaten by waterfowl, and rhizomes and stems by muskrats. The USDA has documented that the common reed has low protein value (U.S.D.A., Forest Service, 2002)

A recent study of common reed on the distribution of birds in Connecticut tidal marshes concluded that homogenous stands of common reed do not provide suitable habitat for many species of wetland birds (Benoit & Askins, 1999). Marsh Wren, Red-winged Blackbird, Swamp Sparrow, and Tree and Barn Swallows dominated the bird community in *Phragmites* marshes. This study showed that stable, discrete patches or narrow bands of *Phragmites* around salt marshes may in fact increase the amount of "edge" habitat preferred for nesting by many marsh birds. These observations highlight the difference between mono-specific *Phragmites* wetlands compared to native plant communities with inclusions of *Phragmites* stands or the presence of a narrow border of common reed.

Other studies have also shown that unbroken, monotypic stands of tall, emergent vegetation generally have lower quality breeding habitat than diverse vegetation stands with more "edge" habitat and openings. A study of a Danish marsh by Moller

(in Lapin and Randall, 1993) showed that areas overgrown by *Phragmites* and tall *Scirpus* spp. had greatly reduced numbers of ducks and waders and entirely lacked gulls and terns.

Common reed is usually the dominant or co-dominant plant, sometimes existing with cattails (*Typha lattifolia),* bulrush (*Scirpus*), or salt marsh grass (*Spartina alterniflora).* It displaces other plants because it grows and spreads rapidly, shades other plants and accumulates a large amount of leaf litter that covers and shades the substrate. This domination results in notable differences in the physical environment. *Phragmites* has such a high evapotranspiration rate, that it can lower the local water table. Increased separation between the marsh surface and the ground water elevation can also result from the increased rate of accumulated leaf litter (peat) in *Phragmites* marshes, because *Phragmites* plants produce a significant mass of above ground growth its production rate exceeds decomposition rate in saturated environments. As peat dries out and the oxygen levels increase, however, enhanced decomposition of the peat occurs because bacterial populations can grow in the oxygenated environment and increase decomposition of the litter causing a physical depletion of the peat resulting in lower marsh elevations. Because *Phragmites* can dry out the substrate, it can damage habitat for organisms such as aquatic benthic invertebrates and crabs (Cronk and Fenessy, 2001)

A study conducted in 1999 on the population status and the habitat and area requirements of Golden-winged and Blue-winged Warbles by the Lab of Ornithology and Ithaca College found that many wetland sites that had been invaded by *Phragmites* had few nesting birds of any species and appeared to have no nesting Golden-winged Warblers. This study suggests that wetlands with natural vegetation are very important for survival of this particular species and that invasion by *Phragmites* may be very detrimental (Confer and Barker, 2000). Adverse impacts to benthic organisms can result from the increased sediment trapping around the basis of the *Phragmites*, a reduction of species that are dependent upon water flow was reported by McIninch, Garbisch, and Salvaggio (1996).

Phragmites can be considered a wetland management problem due to its ability to rapidly colonize and dominate disturbed soils. In this capacity it is capable of invading adjacent areas and crowding out other wetland plant species, reducing the overall plant diversity of the affected system (Ailstock, *et al.*, 2001). Its domination may supplant other species considered to be more important as food and cover for wildlife.

In summary, the wildlife habitat value of common reed dominated wetlands is dependent upon a number of factors. It is generally found to provide less nutritional value than native marsh plants and often supports a less diverse bird population than marshes dominated by native species. However, based on the variety of observation presented in the literature, one needs to evaluate its effectiveness on a case-by-case

basis. This is especially true in an urban environment where a *Phragmites* marsh may provide the only marsh habitat available to area wildlife.

Sediment/Shoreline Stabilization – This function considers the effectiveness of a wetland to stabilize streambanks and shorelines against erosion.

Phragmites plants develop dense tangles of roots and rhizomes that bind sediment/soils to protect shorelines from wave action and erosion.

Nutrient Removal/Retention/Transformation – This function considers the effectiveness of the wetland as a trap for nutrients in runoff water from surrounding uplands or contiguous wetlands and the ability of the wetland to process these nutrients into other forms or trophic levels. One aspect of this function is to prevent ill effects of nutrients entering aquifers or surface waters such as ponds, lakes, streams, rivers, or estuaries.

Emergent vegetation such as common reed has a large network of roots and rhizomes to store nutrients (nitrogen and phosphorus) in perennial tissues. Emergents take up nutrients from the soil pore water establishing a gradient between the water column and the soil which improves overall nutrient retention. Common reed has high nutrient uptake capacity primarily due to its large size. Studies of uptake of metals, which are essential micronutrients for living organisms, found that common reed accumulates iron, lead, zinc, cadmium, and copper in the roots and rhizomes with some indication that the translocation of the metals to the shoots are impeded (Cronk and Fenessy, 2001).

3.3.4.1 Wetland Functions and Values of *Phragmites* in the Muddy River Wetlands

The Back Bay Fens

The expansive stands of common reed present in the Back Bay Fens and the associated upland parkland occupies approximately 2 acres, and is utilized by the birds and small mammals present in the Back Bay Fens. The river and park are located in an urban setting surrounded by dense urban and residential land uses. Although common reed provides less than optimal habitat value and poor nutritional value for wildlife, the common reed patches in the Back Bay Fens provides much of the only perching, nesting and cover habitat available in this area of Boston.

The *Phragmites* stands along the river have the capacity, and do, trap sediment as evidenced by the expansion of these stands into the river channel from the banks over time. This ability of these *Phragmites* stands to trap sediment is so effective that these stands have greatly reduced the effective width of the river in the Back Bay Fens thus resulting in a decreased channel capacity, which is a major factor to area flooding during large storm events. These stands are also presumed to provide shoreline stabilization as well as some nutrient retention functions.

The Riverway

The wetlands in the Riverway corridor consists of a complex of dense stands of common reed at specific locations, intermixed with trees and shrubs along the river's edge. The vegetation along the river banks serve to stabilize the shoreline and trap sediment. The *Phragmites* stands are effective at sediment stabilization due to their dense growth form and persistent stalks. Again, the ability of common reed to trap sediment has resulted in channel blockage at several locations such as near Back Bay Yard and the Island Bridges area near Netherlands Road and Brookline Avenue.

The wildlife habitat value of the common reed dominated pockets of emergent marsh are of lesser value than the common reed wetlands in the Back Bay Fens as they represent small fragmented pockets of reed stands that are located adjacent to and separated by busy urban thoroughfares, such as the Riverway and the Jamaicaway.

3.3.4.2 Comparison of Functions and Values of *Phragmites* Cover to Proposed Conditions

As documented in the above sections, the *Phragmites* stands in the Fens and the patches along the Riverway portion of the Muddy River provide few wetlands functions/values. The documented functions/values include; sediment trapping, shoreline stabilization, nutrient retention and limited wildlife habitat.

The ability of *Phragmites* to trap sediment is well documented in the Muddy River by the extent to which these stands have expanded into the channel and reducing channel carrying capacity. Hydraulic analyses conducted for this project have documented that *Phragmites* removal in these areas will restore channel capacity and have a beneficial effect storm damage prevention and flood control. Although a benefit to water quality, sediment trapping and the growth pattern of common reed together have conspired to decrease the effective flood flow capacity of the river channel and is a contributing factor to area flooding.

Therefore, removal of the *Phragmites* stands will have a positive effect on the ability of the river to convey flood flows and protect the storm damage prevention and flood control interests of the Act. Implementation of the BMP program will reduce the annual sediment load conveyed to the river from urban runoff compared to historic and existing conditions. Therefore, the need for sediment trapping in the river will be of less significance. Furthermore, one of the project elements includes construction of in-stream basins to trap sediment in specific locations and prevent it from being conveyed downstream, without the detrimental effects of reducing channel capacity, will compensate for the *Phragmites* removal.

Phragmites growing along the riverbanks stabilize the banks and prevent soil erosion. Replacement of common reed with other plant species will serve to stabilize the soils to the same degree as common reed. Therefore, no change to the shoreline stabilization is anticipated. Redington (1994) reports that sweet pepperbush is an

effective plant to stabilize soils due to its system of dense roots and underground branches, and other identified plants are good soil stabilizers too.

As discussed above, the *Phragmites* stands provide limited wildlife habitat functions/values due to decreased species and structural diversity as well as limited nutritional value provided by common reed. The proposed riparian zone planting plan utilizes native plants (trees, shrubs and herbaceous plants) to replace *Phragmites* and lawn areas resulting in improved structural and species diversity. Increased structural and species diversity will improve the wildlife habitat capacity of the riparian corridor compared to existing conditions. As stated in Pianka, 1983, "*Structurally complex habitats obviously offer a greater variety of different microhabitats than simple habitats do. Because there are more different ways of exploiting them, such spatially heterogeneous habitats usually support more diverse species than homogenous ones do; …*" The proposed plantings will provide nesting perching, and cover habitat, similar to habitat provide by *Phragmites*.

Table 6-2 of the Draft EIR presented the proposed planting list for use in restoring the plant communities along the river. That list includes a number of species that provide habitat value and will serve as a food source. Several species such as silky dogwood, winterberry, common elderberry, and arrowwood will provide food sources to wildlife; while others species such as alder, sweet pepperbush and spicebush provide good cover and nesting habitat (Redington, 1994). Increased structural diversity of the proposed the planting plan including herbaceous materials, shrubs and trees will provide a structurally diverse community compared to the nearly mono-specific *Phragmites* stands. Thus, providing improved habitat conditions compared to existing conditions.

In conclusion, principle functions and values provide by *Phragmites* will be maintained, and other principle functions and values which are supported by the Muddy River wetlands will be improved as a result of the proposed project, as documented in Table 3-3 below. The primary purpose of the project is to improve the Flood Flow Alteration (flood control and storm damage prevention) functions, and that objective is met. Sediment and Toxicant Retention and Nutrient Removal functions in the Back Bay Fens and Riverway are primarily supported by the *Phragmites* stands present within the river in those segments. However, removal of *Phragmites* from within the channel will diminish these functions. Implementation of the watershed BMP program will reduce the sediment load to the river, while construction of the in-stream sedimentation basins will compensate for *Phragmites* removal and its ability to trap sediment.

Table 3-3

Comparison of Existing Conditions Principle Functions and Values to Proposed Wetland Functions and Values

Location	Flood Flow Alteration	Fish & Shellfish Habitat	Sediment & Toxicant Retention	Nutrient Removal	Wildlife Habitat	Recreation	Endangered Species Habitat
Back Bay Fens Victory Garden							
Existing	Y		Y	Y			
Proposed	Improved	Improved	Maintained		Improved		
Riverway Area							
Existing	Y		Y	Y			
Proposed	Improved	Improved	Maintained		Improved		
Leverett Pond							
Existing		Y				Y	
Proposed		Improved			Improved	Maintained	
Willow Pond							
Existing		Y				Y	Y
Proposed		Improved			Improved	Maintained	Maintained
Wards Pond							
Existing					Y	Y	
Proposed		Improved			Maintained	Maintained	

The river system provides additional functions and values beyond the limited functions of the *Phragmites* stands. The wetland functions and values of each river segment is described above and presented in Table 3-1, and a comparison of principle functions and values for existing and proposed conditions is presented in Table 3-3. The project will maintain and improve wetland functions (interests of the Act) presently supported by the Muddy River wetlands. In particular the dredging component of the project will improve the flood flow alteration (flood control and storm damage prevention) functions as well as the fish habitat (fisheries) in the Back Bay Fens and Riverway segments. Restoration of the riparian plant community will improve the wildlife habitat of the banks compared to existing conditions. Removal of the *Phragmites* stands within the river in the Fens and Riverway will diminish somewhat the sediment and toxicant retention functions, and nutrient removal capacity of these two river segments. The in-stream sedimentation basins are proposed to retain sediment transported to the river via non-point and point sources. This will mitigate for the loss of *Phragmites* which currently trap sediment conveyed

through the river. Please note, the sediment load to the river will be reduced with the implementation of the BMP plan described in Section 5, however, this will not eliminate the transport of sediment to the river. Therefore, the basins are proposed the retain the sediment retention capacity of the river system. Whereas a significant proportion of the pollution conveyed in runoff is adsorbed or absorbed to sediment (Schueler, T.R., 1987) retaining sediment will serve to retain pollutants conveyed in runoff. Removal of the *Phragmites* stands will also diminish the nutrient removal capacity of the river compared to existing conditions. Nutrient removal by plant uptake is a temporary removal or sequestering of nutrients during the growing season, only to be released after the plant matter decays in the river. So removal of the reed stands will also serve to remove of nutrient source. The sediments also contain significant percentage of organic matter, and their removal will serve to remove another nutrient source present in the sediments.

Dredging in Leverett, Willow and Wards Ponds will improve fish habitat while the proposed landscaping plan will improve and/or maintain wildlife habitat, recreation and endangered species habitat as applicable to each pond. Please refer to Section 9 of this Final EIR for a discussion of the potential impacts to Three Spine Stickleback and proposed measures to mitigate construction period and long-term impacts to this protected species and its habitat.

In summary, the proposed dredging project, including the in stream basins and landscaping is anticipated to improve the principle functions of flood flow alteration, fish habitat and wildlife habitat capacities of this urban river system. The project will maintain the sediment and toxicant retention , recreation and endangered species habitat capacity of the river system. Although there may be a slight decrease in the river's capacity to remove nutrients from the water column, this impact will be mitigated by the removal of organic rich sediment present in the river, and the proposed BMP program which includes source control (e.g. street sweeping). Based on the discussions above, no net loss in wetland functions and values is anticipated as a result of this project.

3.3.5 Wetland Impacts and Mitigation

A summary of wetland impacts for the project is presented in Table 3-4 for the entire project. The project will result in no net loss of resources along the entire project corridor. Specific project elements will improve resource conditions or result in a net increase of resources along the river. Sheets 1 through 34 in Section 12 of this Final EIR section present the proposed planting scheme for the river corridor and indicate areas of the wetland restoration and replication. Note areas of BVW alteration are portions of the river where the Olmsted shoreline will be re-established, resulting in a change of BVW to Inland Bank or Land Under Water.

Back Bay Fens

The principle wetland functions provided by the wetland resources in the Back Bay Fens are: 1) flood flow alteration, 2) sediment and toxicant removal, and 3) nutrient

Table 3-4

Summary of Wetland Impacts for each River Segment

Wetland Resource Areas		***Back Bay Fens***	***Riverway***	***Leverett Pond***	***Willow Pond***	***Wards Pond***	***Total***
Bank (l.f.)	Existing	13,540.	12,670	4,540	800	1,260	32,810
	Proposed	15,345	12,670	4,540	920	1,260	34,615
	Change	1,805*	0	0	120	0	*1,925 l.f.*
Land Under Water (ac.)	Existing	16.2	9.4	9.9	0.6	1.8	37.9
	Proposed	19.0	9.4	9.9	0.5	1.8	40.6
	Change	+2.8**	0	0	-0.1	0	*+2.7 acres*
BVW (ac.)	Existing	0.4	0.7	0.2	0.8	0.6	2.7
	Proposed	0.8	0.6	0.3	0.8	0.4	2.9
	Change	+0.4	-0.1	+0.1	0	-0.2	*+0.2 acres*

* This increase results from daylighting the Muddy River at Avenue Louis Pasture and the former Sears Parking Lot.

** This 2.8 acre increase includes 1.8 acres of exposed open water from *Phragmites* removal plus 1 acre of new LUW from daylighting the Muddy River at Avenue Louis Pasture and the former Sears Parking Lot.

Note: BLSF is defined by the FEMA mapped 100-year flood plain and Riverfront Area is defined by a 200-foot line offset from the mean annual flood elevation. The proposed dredging project will not change the extent of either wetland resource area and therefore they are not presented in this table.

removal. Dredging in the Back Bay Fens will improve the flood flow alteration by removing approximately 1.8 acres of *Phragmites* from Land Under Water. This project element will also improve fisheries habitat in the Fens by increasing water depth and expose more riverbed, and removing *Phragmites* will create more open water habitat in the Fens. In stream sediment basins will serve to trap sediment and pollutants adsorbed and absorbed to particles. Measures to mitigate dredging impacts are presented in Section 4.4.4.2 of this Final EIR.

Removal of the culverted sections (i.e. daylighting the river) of the Muddy River will result in an increase in Inland Bank and Land Under Water resources along the project corridor. The planting plan does not specifically identify replication of Bordering Vegetated Wetlands (BVW) in these two locations where the river will be restored to open channel flow. However, the proposed plant list, see Table 6-2 of the Draft EIR, includes numerous wetland indicator plants, making it possible to develop a self sustaining wetland plant community along the new shoreline to be exposed in these two areas.

The majority of the BVW present in the Back Bay Fens are narrow fringing wetland stands along the banks of the Muddy River. Impacts to BVW are mostly associated with the implementation of the Olmsted planting plan and bank restoration activities. Much of the delineated BVW resource area is stands of *Phragmites* on the shoreline. The planting plan will replace these pockets of common reed, a non-native invasive plant species, with a continuous band of native plant species providing a diverse habitat cover of trees, shrubs and herbaceous plants. The proposed shoreline community will improve the habitat characteristics compared to the existing conditions.

Soil erosion and sediment control measures will be deployed during Inland Bank and BVW restoration activities to prevent the transport of sediment to the river during earth working and planting activities. Erosion control practices including mulching, use of erosion control blankets and temporary seeding will be utilized as necessary to control erosion. Sediment control barriers including silt fence and/or hay bale barriers and silt curtain will be used to prevent the transport of sediment to and through the river during work in wetlands and along the shoreline. Sedimentation barriers will remain in place until exposed soils are permanently stabilized. A project specific sedimentation and erosion control plan and specifications will be prepared as part of the final design phase of this project. This document will be forwarded to environmental permit issuing agencies as applicable.

Riverway

The principle wetland functions provided by the wetland resources in the Back Bay Fens are: 1) flood flow alteration, 2) sediment and toxicant removal, and 3) nutrient removal. Dredging will improve the flood flow alteration. This project element will also improve fisheries habitat by increasing water depth and exposing cleaner sediments. In stream sediment basins will serve to trap sediment and pollutants

adsorbed and absorbed to particles. Measures to mitigate dredging impacts are presented in Section 4.4.4.2 of this Final EIR. Impacts in the Riverway section of the river will result from channel dredging and bank restoration. As documented in Table 3-4, there is no loss of Inland Bank or Land Under Waterway resource areas. The dredging and bank restoration activities will alter these resources from existing conditions but result in no loss of resource areas.

Dredging will remove contaminated sediments and expose cleaner sediment improving the habitat quality of the Riverway section, especially for benthic organisms and fishes present in the river. Portions of the bank are comprised of exposed soils and these areas are subject to erosion. Bank restoration is needed to re-grade the shoreline as a transition from the dredged channel to the uplands, stabilize areas subject to erosion, and remove stands of *Phragmites* and buckthorn (*Rhamnus frangula*), two invasive plant species, present in the riparian zone. This work will alter the characteristics of the bank from its current condition. As documented above, the existing shoreline provides limited wetland functions and values, while the proposed shoreline re-vegetated with a diverse plant community is expected to provide improved habitat characteristics and a stabilized shoreline.

The areas of BVW along the Riverway are narrow bands of vegetation along the riverbank. The project will involve re-grading the bank and re-establishing a more diverse plant community to restore the Olmsted plan, as described above. This work will alter the existing plant communities within delineated BVW but will not result in a significant loss of BVW area. A final grading plan for the shoreline restoration activities is not completed to date. However, a approximately a 0.1 acre loss of BVW is anticipated. Compensation for this loss is provided by the establishment of additional area of BVW in the Back Bay Fens and around Leverett Pond.

Construction period mitigation measures described above for the Back Bay Fens will be utilized for work in the Riverway as well. A project specific sedimentation and erosion control plan and specifications will be prepared as part of the final design phase of this project. This document will be forwarded to environmental permit issuing agencies as applicable.

Leverett Pond

Principle functions and values provided by Leverett Pond are fisheries habitat and recreation. The majority of work within wetland resource areas in Leverett Pond will occur within Land Under Water for dredging and Inland Bank for restoration of Olmsted plantings. This work will not adversely affect the principle function and value of the pond. Dredging the pond will remove accumulated sediment from approximately 9.9 acres of the pond. This will expose cleaner sediment and result in deeper water depths in the pond. Exposing less contaminated sediment will improve conditions for benthic organisms that recolonize the newly exposed substrate, and increasing the pond depth will provide expanded habitat for pelagic organisms.

Restoring a more diverse plant community along the pond's bank will involve alteration of the bank to re-grade the bank contours and to remove existing vegetation not consistent with the Olmsted plan. Once preparation work is completed the bank will be replanted to create a structurally and species diverse plant community along the shoreline. This will improve habitat capacity compared to existing conditions and serve to stabilize the bank. No loss of Inland Bank will occur as a result of this work. The proposed planting work will occur within the small pockets of BVW present along the shoreline. The planting work, described above, will replace existing plants in the pockets of BVW with other wetland species consistent with the Olmsted design. Based on preliminary designs, it is anticipated that approximately 0.1 acres of new BVW can be established along the Leverett Pond shoreline.

Construction period mitigation measures described above for the Back Bay Fens will be utilized for work in Leverett Pond as well. A project specific sedimentation and erosion control plan and specifications will be prepared as part of the final design phase of this project. This document will be forwarded to environmental permit issuing agencies as applicable.

Willow Pond

Principle functions and values provided by Willow Pond are fisheries habitat, endangered species habitat and recreation. Work in Willow Pond is very similar to that proposed in Leverett Pond – dredging and bank restoration. The differences are that Willow Pond is extremely shallow, about two feet deep, providing limited habitat for fishes and other aquatic organisms. Dredging the pond will improve fisheries habitat by providing a deeper habitat compared to existing conditions. Potential impacts and mitigation measures to endangered species habitat and to the population of Three Spine Stickleback present in the pool at the Spring Pond discharge is described in Section 9 of this Final EIR. A slight loss, approximately 0.1 acre, of Land Under Water will occur as a result of creating a small island within pond. This will provide an additional 120 linear feet of Inland Bank associated with Willow Pond. The loss of 0.1 acre of Land Under Water in Willow Pond is compensated by the increased area of Land Under Water resulting from dredging in the Back Bay Fens (1.8 acres) and daylighting the river in two sections in the Fens (1 acre) resulting in a net increase of 2.7 acres of Land Under Water within the Muddy River system.

Construction period mitigation measures described above for the Back Bay Fens will be utilized for work in Leverett Pond as well. A project specific sedimentation and erosion control plan and specifications will be prepared as part of the final design phase of this project. This document will be forwarded to environmental permit issuing agencies as applicable.

Wards Pond

Principle function and value of Wards Pond is wildlife habitat and educational/scenic value. This function and value and will not be lost as a result of this project. Similar

to the work in the two downstream ponds, work will occur within Land Under Water and Inland Bank for pond dredging and bank restoration, respectively. Bank restoration will also involve work within BVW. Dredging and bank restoration will not resulting the loss of Land Under Water nor Inland Bank, as presented in Table 3-4. However, this work will involve re-grading the bank and re-establishing a more diverse plant community to restore the Olmsted plan, as described above. This work will alter the existing plant communities within delineated BVW but will not result in a significant loss of BVW area. A final grading plan for the shoreline restoration activities is not completed to date. However, a approximately a 0.2 acre loss of BVW is anticipated. Compensation for this loss is provided by the establishment of additional are of BVW in the Back Bay Fens and around Leverett Pond.

Dredging the pond will remove accumulated sediment from approximately 1.8 acres of the pond. This will expose cleaner sediment and result in deeper water depths in the pond. Exposing less contaminated sediment will improve conditions for benthic organisms that recolonize the newly exposed substrate, and increasing the pond depth will provide expanded habitat for pelagic organisms.

Restoring a more diverse plant community along the pond's bank will involve alteration of the bank to re-grade the bank contours and to remove existing vegetation not consistent with the Olmsted plan. Once preparation work is completed the bank will be replanted to create a structurally and species diverse plant community along the shoreline. This will improve habitat capacity compared to existing conditions and serve to stabilize the bank.

Construction period mitigation measures described above for the Back Bay Fens will be utilized for work in Wards Pond as well. A project specific sedimentation and erosion control plan and specifications will be prepared as part of the final design phase of this project. This document will be forwarded to environmental permit issuing agencies as applicable.

3.3.5.1 Replication Areas and Restoration Areas

The location of wetland replication and restoration areas are shown on the Sheets 1 through 34 located in Final EIR Section 12. Note, areas of wetland restoration are areas of delineated BVW that will be replanted with native wetland species from the Olmsted plant list that will replace existing stands of non-native plant species. Replication or replacement wetlands are plant communities that will be established where no BVW currently exists. The location and extent of replication and replacement wetlands shown on the above referenced figures is preliminary. Final location and extent will be determined based on final grading plans to be developed during final design. Restoration of riverbank plant community with a more diverse community comprised of native plantings, as described above in Section 3.3.4.2, plus other project components and mitigation measures will result in no net loss of wetland functions or values compared to existing conditions. See Table 3-3 for a

comparison of the river's principle functions/values for existing and proposed conditions.

Restoration and replication of wetland plant communities are proposed along the banks of the Muddy River, as shown on Sheets 1 through 34 in Final EIR Section 12. Typical cross sections of the river at 10 locations are presented in Sheets 35-45 in Final EIR Section 12. The proposed restoration and replication areas are designed within the same elevation range on the river banks as existing wetland plants. This is expected to provide sufficient hydrologic conditions in the restoration and replication areas to support the wetland plants. The final planting plans will be prepared during the final design stage and presented in the permit applications for review and approval by the issuing authorities.

Topsoil

Topsoil for use in the wetland restoration and replication area will be organic rich loam. The soil will be friable and capable of promoting and supporting healthy plant growth. Manufactured organic rich loam is acceptable for use. Organic rich loam will have a pH between 5.5 and will be classified as sandy loam, loam, or sandy clayey loam. Organic content will range between 8 - 10 % as determined by loss on ignition of moisture free test sample oven dried to a constant weight at a temperature of 100 degrees Centigrade.

Natural topsoil in New England typically has an organic content of 3 - 5 %. Therefore, soil amendments will be needed to adjust soil to manufacture an organic rich loam. Organic amendments for use on this project to create an organic rich loam will include compost - defined as a stable, humus-like material produced from the aerobic decomposition of organic residues. Organic residues may include biosolids as well as yard wastes, and agricultural wastes. The compost will be capable of supporting plant growth in conjunction with addition of fertilizers and other amendments as applicable. The compost will contain at least 40% organic matter (dry weight) and 100% of the material should pass a 3/8-inch (or smaller) sieve. debris such as metal, glass, plastic, wood (other than residual chips) asphalt, masonry, etc shall not be visible and should not exceed 1% dry weight of the compost.

Organic rich topsoil will be used to create finish grades in the wetland replication area to a depth of 6 to 12 inches. The toe of-slope, where necessary, will be stabilized with a stone toe, gabion structure, coir fascine, or similar toe stabilizing material. Where stone is utilized, filter fabric will be installed to prevent the loss of soil through the stone toe protection.

After soils are placed and compacted as specified, the wetland restoration/replication areas will be planted per the final landscaping plan. After planting of trees, shrubs and ground cover is completed, a woven pervious weed barrier fabric will be installed over the disturbed soils and mulch will be installed to stabilize the soils.

Monitoring
The wetland restoration and replication areas will be required to meet the performance standards for wetland replacement areas as defined in the Massachusetts Wetland Protection Regulations [310 CMR 10.55(4)(b)(1-7)]. These standards require the area to support at a minimum 75% cover by native wetland plant species at the end of two complete growing seasons.

After planting is completed the wetland restoration and replication areas will be inspected to ensure that the work was completed in accordance with the plans and specifications with regard to number of plants, plant species, size and location. Any corrective measures identified during the initial inspection will be addressed.

Inspections of the restoration and replication areas will be required for a two year monitoring period to determine if the performance standards of 310 CMR 10.55 are met. The inspection will monitor depth of soil saturation, water depths, plant community composition and plant community structure along established transect(s). The monitoring procedure will follow the Massachusetts DEP wetland documentation sampling procedure as described in their publication Delineating Bordering Vegetated Wetlands, March 1995. This procedure is essentially the same as the Corps wetland documentation procedure. Any deficiencies will be noted and appropriate action will be recommended to bring the areas into compliance with the plans and specifications or to ensure success of the restoration and replication efforts. Annual reports will be submitted to the Conservation Commissions after each of the two growing seasons to describe the areas and present recommendations for remedial actions, if needed.

Phragmites Removal
Section 2.3.4 of the Draft EIR discussed a couple of different methods for *Phragmites* removal and control. As described in the Draft EIR, common reed growing within the channel will be removed during the dredging activities. The *Phragmites* mats will either be removed by mechanical means during the dredging operation, or by via the hydraulic dredge. The root mat and attached above ground stalks will be disposed of with the dredged sediment.

Phragmites growing along the riverbanks, beyond the limit of dredging, will need to be removed by other means. As described previously, a combination of herbicide application and mechanical removal of reeds and their roots is proposed. Initial *Phragmites* removal along the riverbank, especially within wetland restoration and replication areas is a two-step process, followed by on-going inspection and maintenance. Initially, it is recommended to cut *Phragmites,* as well as other invasive species such as buckthorn (*Rhamnus cathartica*), during the active growing season and apply a glyphosate based herbicide (e.g. Rodeo or Roundup are two brand names of glyphosate herbicides) to the cut stalks. This will kill the target plant as well as its roots and rhizomes. Even in areas where the bank will be re-graded it is recommended to apply herbicides to kill the roots and rhizomes prior to starting earth

work. Glyphosate herbicides can be applied by backpack sprayers or applied to individual plants by hand. This is a non-selective herbicide and will kill target as well as non-target species. Therefore care must be used if surrounding plants are to be retained. In areas of dense mono-specific stands of *Phragmites* spraying is most effective.

After the invasive plants have been cut, treated and roots removed, where applicable, the finish grades will be established consistent with the final grading plan using topsoil as described above. Wetland plants will be installed and soil stabilized either with ground cover plantings, mulch or erosion control mats. Planting of trees and shrubs will assist to contain the re-establishment and spread of *Phragmites* as it requires full sun (Thunhorst, G.A., 1993). Planting of trees along the river can be considered a long-term "BMP" to control *Phragmites*, note the lack of *Phragmites* growing under the willow trees in the vicinity of the Boston Fire Department facility in the Back Bay Fens.

After the planting is completed, routine inspections and maintenance of the Olmsted plantings will be required to cull out invasive plants including *Phragmites*. Again two procedures are proposed – hand pulling and herbicide application. Species such as buckthorn and other undesirable species with discrete and intact root systems can be hand pulled or dug out, as specimens are observed during routine inspections and maintenance activities. The removed plants need to be disposed of in a manner to prevent their spread to other locales. Species that produce viable rhizomes, or that have dense root mats or breakable stalks (e.g. *Phragmites* or purple loosestrife) should be removed via herbicide applications. Whereas this will occur after the establishment of the desired plantings, it is recommended that individual specimens be treated as they are observed during routine inspections, rather than spraying. Treating individual plats will prevent the accidental application to desired plants. It is anticipated that inspections and treatment will be required two to three times in the first two years after the Olmsted plantings are established. Over time, sources of invasive plants from the surrounding area or soil seed bank are expected to diminish resulting in reduced occurrences of invasive plant species over time.

3.4 In-Stream Sedimentation Basins

3.4.1 Purpose and Location of Basins

Eight in-stream sedimentation basins are proposed – three in the Back Bay Fens area, three in the Riverway area and one each in Leverett Pond and Willow Pond. These basins are proposed to be constructed as part of the overall dredging activities. The purpose of these sediment basins is to provide a location within the river channel to collect sediment conveyed to and through the river, and to prevent it from being dispersed throughout the river channel and reducing channel cross-sectional area. The proposed storm water BMP as described in Section 5 of this Final EIR is designed to reduce the sediment load discharged to the Muddy River via a series of structural and non-structural best management practices. This program will reduce the volume

of sediment conveyed to the river, but cannot treat all runoff and remove all sediment carried in storm water. The proposed reduction via implementation of the BMP program will serve to improve river water quality and reduce the volume of sediment discharged to the river. The in-stream basins are strategically located downstream of outfalls and after narrow river segments to facilitate the settlement of sediment out of the water column at discrete locations not removed by the approved BMP treatment devices. These locations are also accessible for maintenance dredging in the future.

Sediment can settle out in the in-stream basins because the larger channel cross-sectional capacity at these locations can convey the same flow rate at a reduced velocity compared to a narrower or shallower stretch of the river. Flow rate is a unit of volume per time (e.g. cubic feet per second [cfs]), a channel cross section is measured in area (e.g. square feet), thus, dividing flow rate by the channel area yields flow velocity (e.g. feet per second). Therefore, the water velocity changes as water moves through the river depending upon the channel cross sectional area for a constant flow rate. Construction of the in-stream basins will increase the channel area, resulting in reduced water velocity through the in-stream basins. Reduced water velocity allows sediment to settle out of the water column rather than to remain in suspension. The basins have been strategically placed to settle out suspended solids to reduce flow velocity and trap sediment.

Urban runoff is documented by others (Schueler, T.R. 1987) to contain contaminants either adsorbed or absorbed to sediment particles. Trapping the sediment in specified locations will prevent the transport of polluted sediment throughout the river which ultimately discharges to the Charles River. In the future, smaller scale dredging projects can be implemented to remove the accumulated sediment from these discrete traps and avoid the need for a large-scale project to remove sediment from the entire river. Therefore, this project element is proposed to improve the capacity of Land Under a Waterway to prevent the widespread distribution of pollution conveyed with sediment contained in runoff, while having no adverse effects to the other interests of the Act.

This project element will improve the prevention of pollution function of the river as described above by removing a source of pollution present in the river, as well as by retaining sediment carried to the river from urban runoff in discrete areas of the river to prevent the transport of pollution (sediment from urban runoff) throughout the river corridor. The project includes the development and implementation of a watershed BMP plan to reduce the sediment load to the river from the tributary area. This will be implemented and will decrease the volume of sediment conveyed to the river compared to historic and existing sediment loadings. However, sediment will continue to be conveyed to the river with urban runoff. The in-stream sediment basins will serve as additional sediment traps to augment the upgradient BMP program to reduce the dispersal of sediment throughout the river channel.

3.4.1.2 Back Bay Fens

In the Back Bay Fens, the in-stream basins are located:

- Immediately downstream of the Fens Bridge at Avenue Louis Pasteur,
- At the Boston Gatehouses, and
- Downstream of the Agassiz Road bridge near the Duck House.

The Emmanuel College drain overflow discharges runoff at the Avenue Louis Pasteur. Placement of an in-stream basin at this location will trap sediment near the outlet of this drain to prevent its transport further downstream. During wet weather the river experiences increased flow rates due to this drainage outlet. Providing an in-stream basin at this point will greatly reduce water velocity at the drainage outlet and improve the settling rate in the river at the outlet compared to no in-stream basin at this location.

During major storm events, only, an overflow from the Stony Brook Conduit discharges runoff to the river at the Boston Gatehouses. Sediment carried in runoff from major storm events has settled out near the Gatehouses creating the large sand flat observed in the river at this location. BWSC has completed the cleaning of the Stony Brook Conduit, to reduce the future sediment loading when overflows occur. Nevertheless, construction of an in-stream basin at this outlet will provide a sump to collect sediment discharged from BWSC overflows without reducing the hydraulic capacity of the river at this location. This will serve to trap sediment more efficiently and preserve the flood flow capacity of the river at this station.

The third in-stream basin is located just downstream of Agassiz Road bridge near the Duck House. Although there is no drainage outlet at this location, it is downstream of a narrow section of the river. Due to the narrower channel cross-section, the same rate of river flow will need a flow at a higher velocity compared to river sections with larger hydraulic capacity. Water velocity will increase through the Agassiz Road bridge and narrower channel cross-section in this area. Construction of the in-stream basin downstream of this section will create greater hydraulic capacity thus reducing water velocity and allow sediment to settle out of the water column.

3.4.1.3 The Riverway and Leverett Pond

Five in-stream sedimentation basins are proposed in the Riverway and other upstream sections of the Muddy River. These are located at storm drain outlets to collect sediment conveyed in runoff, except near Back Bay Yard where it is located to trap sediment before flow is conveyed through culverts under the Park Drive/Riverway connector. In-stream basins are proposed at the:

- Near Back Bay Yard (at the inlet to the park Drive/Riverway connector culvert),
- Downstream of Netherlands Road (Longwood Ave. drain),
- Between Brookline Ave and The Riverway at Aspinwall Rd. (Tannery Brook drain),

- In Leverett Pond at the Village Brook Drain, and
- In Willow Pond at the Chestnut Street Drain.

Construction of the in-stream basins in the Riverway, Leverett Pond and Willow Pond are located at drain outlets to settle out sediment conveyed in runoff without loss to the cross-sectional area of the channel restored by this project.

At the Back Bay Yard the basin is proposed at the culvert inlets to trap sediment before it enters the culvert to prevent sediment accumulation within the culverts.

An example of another in-stream basin at a culvert inlet is found in Quincy, MA. The ACOE has constructed a sedimentation basin, or trap, similar in function to those proposed for this project. A concrete basin was constructed in the stream and immediately upstream of the culvert inlet to the Town River in Quincy, MA. The purpose of the sedimentation basin or trap is to prevent sediment from accumulating in the downstream culvert since it would be more difficult to remove sediment from the culvert than the trap. The ACOE reports that the trap is working well and preventing sediment from collecting in the culvert.

The ACOE has included the in-stream sedimentation basins as an important element of the project in their Decision Document. Their justification not only includes the environmental benefits of the basins by controlling pollutant levels in the river, but they are included as a critical maintenance element. The ACOE will require the Proponents to accept a maintenance agreement as a condition of funding the project. They have indicated that they consider the in-stream sedimentation basins as a key element in future maintenance. Interim dredging within the basins would: 1) lessen future impacts compared to a major dredging program in the future, and 2) maintain the capacity of the flow channel.

3.4.2 Existing Sediment Quality

The sediments in the river are documented to contain elevated levels of metals, PAHs, and petroleum hydrocarbons, with PCBs and DDT (and its metabolites) also found frequently (see Draft EIR tables 4-7, 4-12, 4-17, 4-21, and 4-25, and Draft EIR Appendix F in Draft EIR Volume 5). Contaminant concentrations were observed to be higher in surface sediment and to decline with depth (USACE, 2002 unpublished) . Appendix D to the Muddy River Boston and Brookline, Massachusetts Draft Decision Document and Environmental Assessment presents the Sediment Quality and Ecological Risk Evaluation (USACE, 2002, unpublished). That assessment utilized multiple lines of evidence to evaluate the Muddy River sediment quality and potential affects to aquatic organisms. Evidence evaluated for that assessment included:

- Comparison of river sediment chemistry to sediment quality guidelines,
- Comparison of river water quality data to ambient water quality criteria,

- Analysis of bioassays (toxicity tests) compared to reference sediment on growth and survival of test organisms (invertebrate and fish test organisms),
- Analysis of fish tissue and comparison to literature based effect values,
- Evaluation of food chain exposure, comparing daily intake of contaminants of potential concern (COPCs) to threshold response values, and
- Evaluation of food chain exposure for piscivorous wildlife.

The Corps utilized several data sets for the completion of the ecological risk assessment to determine: sediment quality, water quality, benthic community structure, fish community, and fish tissue concentrations of COPCs. The benthic community is dominated by pollution tolerant species and the fishery is typical of a warm water fish community. The risk characterization evaluated the river segments identified as Wards Pond, Willow Pond, Leverett Pond, The Riverway, and Back Bay Fens. The results of the ecological risk characterization concluded that the Muddy River sediment posed a risk to biota that utilize the Muddy River. A summary of specific conclusions is presented below.

Sediment is likely to adversely effect benthic organisms and fish at all stations except Wards Pond, based on comparison of river sediment data to sediment quality guidelines and bioassay test results. Sediment concentration of metals, PAHs, pesticides and PCBs exceeded sediment quality ecological benchmarks, and in many cases concentrations exceed the standard by one or more orders of magnitude making adverse impacts to invertebrates probable. Sediment was documented to be toxic to test organisms exposed to sediment from Willow and Leverett Ponds, the Riverway and the Back Bay Fens, based on studies conducted in 1995 and 2001.

Food chain modeling identified a risk to avian populations at all stations. The Riverway and Back Bay Fens sediment have the highest concentrations of PCBs and the greatest bioaccumulation of PCBs in fish. Consequently, risk to piscivorous wildlife is highest to animals that feed in these two river segments. Risks are also present for insectivorous birds, feeding on insects that emerge from aquatic larval life stages.

3.4.3 Impacts of In-Stream Basins

As stated above, the river sediments are contaminated with decreased contamination concentrations with depth, and the sediment pose a threat the aquatic organisms that inhabit these sediments. The proposed dredging project will remove contaminated sediments exposing native sediments or less contaminated sediments. Over dredging is proposed to construct the in-stream basins. This process will remove sediments to a greater depth in the eight identified locations and exposing cleaner sediments. The impacts of these basins will be two-fold, removal of a greater volume of contaminated sediments from the Muddy River system and construction of basins that will allow the preferential deposition of sediment in these locations to minimize its conveyance and deposition throughout the river corridor. Therefore, the in-stream basins are

considered to afford long-term beneficial impacts to the aquatic environment. Potential effects to aquatic organisms, bottom water quality and maintenance of the basins are discussed below.

3.4.3.1 Aquatic Organisms

As documented above, contaminant concentrations were observed to be higher in surface sediment and to decline with depth. Therefore, removal of contaminated sediments from the river ecosystem will expose clean native sediments, or at worst less contaminated anthroprogenic sediments, thus reducing the adverse impacts to benthic invertebrates and subsequent bioaccumulation and magnification up the food chain. Newly exposed (post-dredging) sediment contaminant levels in most river segments will be significantly lower than existing surface sediment contaminant concentrations (USACE, 2002 unpublished) based on analysis of sediment cores collected at varying depths below the surface. This will result in lower hazard quotients for contaminants of potential concern (COPCs) in the future compared to existing conditions. Improved sediment quality is expected to improve conditions for benthic invertebrate survival, growth and reproduction resulting in improved food resources for fishes as well as insectivorous wildlife (wildlife feeding on insects that emerge from aquatic larval life stages).

In the Back Bay Fens, hazard quotients for mercury increase slightly due to lower total organic carbon, although mercury concentrations decrease with depth. Lower total organic carbon increases bioavailability of mercury. It was noted that several conservative assumptions were included in development of the food chain model which may overstate potential risk, such that actual risk may not increase for mercury. No such phenomenon is anticipated for sediments in the Riverway section and Willow and Leverett Ponds, post-dredging risk to benthic organisms from sediment contamination is reduced in these stretches of the river compared to existing conditions.

During construction, sediment will be removed and reused or disposed of off-site. This will result in the removal of benthic organisms along with the sediment and a short-term removal of the benthic community. This impact will be a short-term loss of the community. This is a riverine system and the entire dredging project will not be conducted in a single phase. Dredging is planned to start in the lower reaches and proceed upstream. This will ensure the continuous presence of benthic organisms in upstream reaches that will be available to colonize down stream areas after dredging is completed. As discussed above, the benthic environment will be improved by the removal of contaminated sediments and will provide a cleaner substrate for organisms colonizing the dredged areas.

Adverse impacts to fisheries are not anticipated by the presence of the in-stream sediment basins. Water depths in the Back Bay Fens and Riverway sections of the river currently range in depth from two to four feet. The proposed dredging project will increase water depths to 6 to 8 feet. At the proposed in-stream sediment basins,

water depths will range from 8 to 10 feet. The Draft EIR documented the presence of warm water fish species in the Back Bay Fens area including American Eel, Bluegill, Common Carp, Goldfish, Large mouth Bass, Golden Shiner, Pumpkin Seed, and Yellow Perch. These warm water fish species are often found in shallow ponds and slow moving rivers in the Commonwealth. Dredging to construct the proposed sediment basins is within the normal depth ranges for these fishes. As documented by the Corps (USACE, 2002 unpublished) in general, sediment contamination decreases with depth and therefore the sediment exposed in the in-stream basins (if not native material) will be less contaminated than existing conditions. Thus, there will be improved sediment quality in the river in the future compared to existing conditions.

During dredging operations dredging zones will be segregated from other river segments by the installation of silt curtains at the upstream and downstream ends of the work zone. Within the work zone fishes and other aquatic organisms will be removed. Methods to remove aquatic species will involve electro shocking the work zone to collect fishes and other organisms present in the work zone. Collected organisms will be transferred to the river either upstream or downstream of the work zone. This will prevent the take of aquatic species by the hydraulic dredge. Once dredging and bank restoration, where needed, is completed in a designated zone the silt curtains will be removed and aquatic organisms will be able to return to those areas. Therefore, no short-term impacts to fishes or other pelagic macrofaunal aquatic species are anticipated during construction. Issues relative to the Three Spine Stickleback are addressed in Final EIR Section 9.

3.4.3.2 Bottom Water Conditions

The study of limnology typically is concerned with deep water bodies that stratify in summer and/or winter. Thermal stratification separates the upper layers of the water column (epilimnion) from the deeper colder layers of the water column (hypolimnion). The thermal stratification of deep water bodies prevents the intermixing of upper and lower layers of the water column. This lack of mixing between the epilimnion and hypolimnion, except during spring and autumn turn over, can result in decreased dissolved oxygen (DO) levels in bottom waters of stratified lakes or other water bodies where there are increased biological or chemical oxygen demanding (BOD or COD) materials in sediments. This is the principle concern of the DEP relative to bottom water conditions caused by over dredging for in-stream sedimentation basins.

Shallow lakes, ponds or other water bodies that remain well mixed and do not stratify and are referred to as polymictic water bodies. Shallow well mixed water bodies are typically considered to be 3 meters (approximately 10 feet) or less in depth (Scheffer, M., 1998). The upper layers in deeper waters generally remain well mixed throughout the year. Stratification typically occurs at depths greater than 4 m (13 feet) below the surface. This was confirmed by CDM for a recent study of shallow reservoirs for the MWRA. The reservoirs are of varying depths, 6 m to 8 m (20 feet to 26 feet) deep and

showed no stratification in spring and autumn seasons. Thermal stratification was observed to varying depths, 4 m to 5 m (13 to 16 feet) in the summer, and DO remained well mixed through out the water column during spring and autumn with stratification observed at varying depths, 5 m to 6 m (16 to 20 feet) deep in the summer (CDM, 2000; CDM, 2001).

The proposed in-stream sedimentation basins will be dredged to depth of eight to ten feet deep, about two feet deeper than surrounding areas. Although the river will be dredged to create a deeper river compared to existing conditions, the increased depths are still shallow enough for the water column to remain well mixed throughout the year. This will prevent the stratification of the water column even within the footprints of the sedimentation basins. Additional conditions that will serve to maintain a well mixed river water column include:

- This is a river and not a reservoir. Water flows through the system which will serve to prevent it from becoming a static system. A static (or stagnant) water body could yield poor water quality conditions throughout the water column.

- This river experiences increased flow rates during storm events. These periodic high flow events serve to flush the system during significant storms. Even after dredging is completed, resulting in a deeper river system, such flushing will facilitate mixing and further prevent stratification of the water column.

In conclusion, no adverse affects to bottom water quality relative to decreased DO levels are anticipated as a result of the in-stream sedimentation basins.

3.4.3.3 Periodic Maintenance

Periodic maintenance will be required to maintain long-term optimal efficiency of the in-stream basins. It is expected that removal of accumulated sediment within the basins will be required approximately every ten years. The project planting plan has been developed to provide access points to each in-stream basin to avoid damage to trees or shrubs on the river bank. Sediment removal within the basins will involve removal of accumulated sediment by either mechanical or hydraulic dredging techniques. Preferred method will need to be determined at the time of dredging.

Impacts to the aquatic environment will include short-term increase in turbidity and removal of localized populations of benthic organisms. Similar to the proposed project, dredge limits will be established by the deployment of silt curtain at the upstream and downstream ends of the work zone, defined at the basin by the size the basin footprint. Dredging will occur within the defined work zone and turbid water will be contained within the work zone by the silt curtain. The silt curtain will not be removed until the water clarity returns to ambient conditions.

Localized removal of the benthic community within the basin footprint will result from periodic maintenance dredging. However, where the entire river corridor will not need to be dredged, there will sufficient "seed stock" of benthic organisms to re-

colonize the exposed sediments of the re-dredged basins. The basins will not be dredged any deeper than the originally designed depths, approximately 2 feet deeper than the adjacent river bottom. As documented above, no adverse effects caused by low DO are expected within the basins after the proposed project and none is expected after future maintenance activities.

Protocols for the protection of fish for maintenance dredging will follow similar protocols proposed in this Final EIR. Fish and other macro-aquatic life will be collected from within the work zone after the deployment of the silt curtains but before dredging commences. Fish and other aquatic life (reptiles and amphibians) will be collected using electro-shock equipment, in all areas except "the pool area" of Willow Pond. The organisms will be re-located outside of the work zone. After dredging at each basin is completed and the silt curtain is removed, the fish, reptiles and amphibians can re-colonize the dredged areas. No long-term impacts to macro-aquatic organisms are expected as a result of the project described in this Final EIR or as a result of future small scale localized maintenance dredging of the in-stream basins. Protocols for handling the Three Spine Stickleback found in the pool area of Willow Pond are addressed in Section 9 of this Final EIR. Note, no work is proposed in Spring Pond, which also provides habitat for the Three Spine Stickleback.

3.5 Water Quality During Dredging

3.5.1 Mixing Zones

DEP requested that the proponent determine site-specific mixing zones for the discharge of filtrate from the dredging operations in the Muddy River. Turbid water (filtrate) can be generated and discharged to the river from dewatering operations associated with hydraulic dredging of the river. Filtrate will be discharged to the river, downstream of the dredge work area. The water available to dilute the filtrate is the water flowing in the Muddy River. A logical place to establish the downstream boundary of the mixing zone would be at the point where discharge is fully or laterally mixed with the receiving river water.

Fischer *et al.* (1979) developed the formulas to establish the length required to attain complete lateral mixing, which depend on a lateral or transverse dispersion coefficient for a stream. The equation for the lateral dispersion coefficient is:

$$E_{lat} = 0.6\ H\ U^*$$

where H = mean depth (m) and U^* = shear velocity (m/s), which is defined as:

$$U^* = (g\ H\ S)^{0.5}$$

where g =the acceleration due to gravity (m/s^2) and S = channel slope.

The length (L_m) to attain complete mixing depends on the location of the discharge point. For the purpose of this analysis we assumed the discharge point will be along the river bank, as opposed to center discharge. Fisher's equation is:

$$L_m = 0.4\ U\ B^2/E_{lat}$$

where U = velocity (m/s) and B = width (m)

An alternative formulation for a side discharge was posed by Yotsukura (1968):

$$L_m = 8.52\ U\ B^2/H$$

Data from the Draft EIR were used to evaluate the mixing zone using the above described equations. Results of the analysis is presented below in Table 3-5. An assumption in these calculations is that dredging will not have been completed at the discharge point so existing conditions reflect the existing river shape and bathymetry. It is anticipated that dredging will proceed from the downstream end and work up river. This will necessitate discharge of filtrate downstream of the work area into an already dredged section of the river. Discharging of filtrate to a deeper and wider river channel will improve conditions for mixing or filtrate resulting in a decreased mixing zone than reported in Table 3-5. The results presented in 3-5 represent a conservative predicted mixing zone for each discharge location.

Table 3-5

Mixing Zones of Dredging Filtrate for the Muddy River

Staging Area	***Distance for Complete Mix (Fischer)***
Agassiz Road	120 ft
Lagoon Area	40 ft
Avenue Louis Pasteur	Cannot be calculated because discharge location unknown. Should be set at end of culvert.
Netherlands Road	70 ft
Leverett Pond	250 ft

In conclusion, a 200 foot mixing zone is an appropriate mixing zone for all discharges, except for the discharge to Leverett Pond. The mixing zone for the Leverett Pond discharge should be a minimum of 250 feet. A 300-foot zone is suggested to ensure adequate mixing in Leverett Pond.

3.5.2 Water Quality Performance Standards

Environmental monitoring performance standards are presented in Section 6 and 11 of this Final EIR, including water quality performance standards. Please refer to those sections.

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4

Section Four

Section 4
Wetlands Protection Act and Water Quality Certification Compliance

4.1 Introduction

4.1.1 Overview of the Wetlands Protection Act

The Massachusetts Wetlands Protection Act (M.G.L. c. 131, s. 40), "the Act" was passed to protect the wetland resources of the Commonwealth. The Act requires that prior to dredging, filling, removing or altering a wetland resource area, one must first file a Notice of Intent (permit application) and receive an Order of Conditions (wetlands permit). The Order of Conditions must include conditions on the proposed project to preserve and promote the public interests identified in the Act which include:

- Protection of public or private water supply
- Protection of groundwater supply
- Flood control
- Storm damage prevention
- Prevention of Pollution
- Protection of land containing shellfish
- Protection of fisheries
- Protection of wildlife habitat

The Act established local administration of the Act through municipal Conservation Commissions.

The Massachusetts Wetlands Protection Regulations (310 CMR 10.00 *et seq.*) "the Regulations" were developed to implement the Act. The Regulations define the procedures to implement the Act, as well as identifying the wetland resource areas, their boundaries and significance, and establishing performance standards for activities proposed in resource areas. The Regulations establish thresholds for activities that can be administered or permitted by the local Conservation Commission. Projects that exceed said thresholds (e.g. alteration of more than 5,000 square feet of bordering vegetated wetland) cannot be permitted by the Conservation Commission, and require a Variance from the Act. The Commissioner of the Department of Environmental Protection (DEP) issues a Variance. Procedures for a Variance are presented in 310 CMR 10.05.

The Regulations also identify a number of activities that can be authorized by the Conservation Commission, or DEP if the local Order of Conditions is appealed, that exceed the established threshold without the need for a Variance. These activities are commonly referred to as "limited projects." Limited projects are activities that serve to protect, preserve or restore the environment and/or the interests of the Act, such that the benefits of the activity outweigh the potential impacts, and/or the delay of the benefit through an extensive permitting process may cause greater harm than benefit. Section 10.53 (3) – (6) of the Regulations identify the limited projects and applicable performance standards.

As described in the DEIR, the wetland resource areas were delineated and the delineation of resources was submitted to the Boston and Brookline Conservation Commissions for review and approval via the Abbreviated Notice of Resource Area Delineation process. The Commissions reviewed the boundaries and issued Orders of Resource Area Determinations, copies of which were presented in Appendix L to the DEIR. Therefore, authorization in accordance with the Act and Regulations will be required to implement this important public project.

The Muddy River Flood Control, Water Quality and Habitat Enhancement, and Historic Preservation Project (the Project) involves work within and adjacent to state jurisdictional wetland resources (Land Under Waterbodies and Waterway, Inland Bank, Bordering Vegetated Wetlands (BVW), Land Subject to Flooding, Riverfront Area and the 100-foot buffer zone to Inland Bank and/or BVW) and will need approval pursuant to the Act. In accordance with the Certificate in the DEIR, this FEIR will describe the project and its components that are eligible to be authorized by the local Conservation Commission(s) as a limited project, and those components that may require a Variance. For those components that may require a Variance, sufficient information is provided to document that: 1) the project provides an overriding public interest, 2) no other feasible alternative exist, and 3) measures are included to mitigate impacts and protect the interests of the Act.

4.1.2 Overview of Water Quality Certification

Section 401 of the Clean Water Act (CWA) requires that states issue a Certification that any proposed filling of waterways or wetlands will comply with the state's Surface Water Quality Standards. The need for a Water Quality Certification (WQC) is triggered when a federal permit is required for the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands. The Massachusetts DEP developed the WQC Regulations (314 CMR 9.00) to administer Section 401 of the CWA as well as the Massachusetts Clean Water Act (M.G.L. c. 21, sections 26 through 53). The WQC Regulations apply to discharge of dredged or fill material, dredging, and dredge material disposal activities in waters of the U.S. within the Commonwealth [314 CMR 9.01(2)].

The applicable definitions presented in 314 CMR 9.02 are the following:

Discharge of dredged or fill material – Any addition of dredged or fill material into, including any redeposit of dredged material within, water of the United States within the Commonwealth. The term includes, but is not limited to:

(a) direct placement of fill, including any material used for the primary purpose of replacing with dry land or of changing the bottom elevation of a wetland or water body,

(b) runoff from a contained land or water disposal area,

(c) redeposit of dredged material including excavated material which is incidental to any activity including mechanized land clearing, ditching, channelization or other excavation, and

(d) the placement of pilings when it has the effect of fill material.

Dredged material disposal – The transport, placement, or deposition of sediments or other material after dredging.

Dredging – The removal of sediment or other material from land under water below the mean high tide line for coastal waters and below ordinary high water for inland waters. Dredging shall not include activities in bordering or isolated vegetated wetlands.

Section 9.06 of the WQC Regulations presents the evaluation criteria for applications for reviewing the discharge of dredged or fill material. Section 9.07 presents the evaluation criteria for applications for dredging and dredged material disposal. The Project includes dredging the Muddy River to increase the flood flow capacity of the river to alleviate flooding and flood damage to public and private property. One would expect that the applicable review criteria for this dredging project is Section 9.07. The DEP interpretation of the definitions presented above expands the definition of discharge of dredged material to include incidental fall back of dredged material during sediment removal (dredging) operations. Therefore, the review criteria for both sections of the regulations (Sections 9.06 and 9.07) are determined by DEP to apply to this dredging project.

4.2 MEPA Certificate and Draft EIR Comments

Wetlands

Both MEPA and DEP requested that more information be provided in the Final EIR regarding the ability of the project to comply with the Wetlands Protection Act. Specific issues include:

- Which aspects of the project can be permitted at the local level (by the Conservation Commissions of Brookline and Boston) and which will require a variance from the Wetlands Protection Act;

- Where a variance is needed, demonstrate how the project can meet the variance requirements;

- Evaluate alternatives to over-dredging including any alternatives required by DEP and an alternative that relies on enhanced stormwater management/BMP implementation in the Muddy River watershed upstream of the Back Bay Fens;
- Include detailed measures for bank-to-bank dredging to prevent sediment transport; and
- Provide more data on in-stream sedimentation basins and their water quality. Analysis should include future dredging, frequency and cost-effectiveness.

Section 4.3 addresses issues pertaining to Wetlands Protection Act compliance.

Other wetland issues raised by MEPA and Draft EIR reviewers include:

- Include more detail (quantitative and qualitative) on alteration and replication of BVW, including areas of permanent loss and areas of replication;
- Provide more detail on specifics of *Phragmites* removal and replication design; and
- Include an analysis of whether any other invasive species will be removed and methods of removal.

Section 3 addresses these other issues.

Water Quality Certification
In his Certificate on the DEIR, the Secretary indicates that the FEIR should provide additional discussion of the project's ability to address WQC issues, including the following:

- Demonstrate that project meets the applicable performance standards in the WQC regulations; and
- Provide an alternatives analysis demonstrating that the proposed over-dredging is the preferred alternative.

DEP also had a number of comments pertaining to WQC issues as follows:

- Discuss in detail WQC jurisdiction;
- Demonstrate that no other practicable alternative exists to the creation of in-stream sedimentation basins;
- Address the potential negative biological impacts of in-stream basins;
- Develop site-specific approach to defining mixing zones;
- Discuss suspended solids limit and how the background is defined;

- Outline corrective actions for water quality exceedances and criteria for defining exceedances;
- Allowable TSS or turbidity to be returned to the river should be linked to the reference location TSS or turbidity;
- Individuals hired to capture and release Three-Spine Sticklebacks will need appropriate certifications/licenses; and
- Capture and release any fish or amphibians impounded within the work areas.

Section 4.6 addresses Water Quality Certification compliance.

4.3 Wetlands Protection Act Limited Project Compliance

Pursuant to the Certificate on the DEIR, this section explores the proper permitting category for the Muddy River Flood Control, Water Quality and Habitat Enhancement, and Historic Preservation Project - i.e., limited project status versus variance, or a combination of the two. The project has several objectives that serve to contribute to the interests of the Act (noted in parentheses):

1) Alleviate flooding along the river corridor and reduce flood damage to public and private property (Flood Control and Storm Damage Prevention);

2) Improve the water quality of the river by restoring river hydraulics to original conditions and removing contaminated sediments (Prevention of Pollution and Protection of Fisheries);

3) Restore river bank plantings to increase plant species diversity and structural diversity to the riparian plant community compared to existing conditions (Protection of Wildlife Habitat);

4) Implement a watershed BMP program to reduce the sediment load to the Muddy River (Prevention of Pollution).

Therefore, four of the basic project purposes serve to restore and protect five of the eight interests of the Act. The objective of historic rehabilitation, while important to the legacy of the park does not address Wetland Protection Act interests.

The following sections discuss the permitting status for project elements and subareas, and presents documentation for DEP to consider when making its decision whether to permit the project pursuant to the limited project provisions or to require a variance.

4.3.1 Dredging

The proposed dredging project will increase the hydraulic capacity of the river and will have very positive effects on the flood control and storm damage prevention

interests, while having no adverse effects on the other applicable interests of the Act. Dredging beyond the minimal channel to restore flood flow capacity is proposed and is referred to as bank-to-bank dredging. Bank-to-bank dredging will remove contaminated sediment as well as *Phragmites* stands present along the river. Removal of contaminated sediment is beneficial to pollution prevention and fisheries, while removal of *Phragmites* is beneficial to wildlife habitat. Removal of *Phragmites* beyond the flood flow channel will also serve to remove a seed source to prevent or minimize *Phragmites* colonization of the river corridor.

The DEP has commented that the limited project status likely applies to portions of the project (i.e. Charlesgate and Back Bay Fens dredging and *Phragmites* removal), while the full bank-to-bank dredging in upstream areas most likely will require approval as a Variance project. The limited project activity authorized by 310 CMR 10.53(4) allows projects to proceed that "*will improve the natural capacity of a resource area(s) to protect the interests*" of the Act, provided the activity does not adversely affect the ability of the resource area to protect the other interests of the Act or results in no change (neutral effect) to the capacity of the resource area to protect the other interests of the Act.

There are no thresholds or upper limits for alterations to Land Under Water or Inland Bank above which a Conservation Commission cannot issue an Order of Conditions. However, Conservation Commissions cannot issue an Order of Conditions for the alteration of more than 5,000 square feet of BVW unless the activity is a limited project activity. As documented in the Draft EIR, the project will require alteration of more than 5,000 square feet of BVW. Therefore, this work must meet the limited project criteria for approval for this work as an Order of Conditions, otherwise a variance issued by the DEP Commissioner will be required.

The work in the Back Bay Fens, the Riverway and three ponds is proposed as a limited project pursuant to 310 CMR 10.53(4) which allows projects to proceed that "*will improve the natural capacity of a resource area(s) to protect the interests*" of the Act.

4.3.1.1 Back Bay Fens and Riverway

The work in the Back Bay Fens and Riverway will improve the capacity of these project areas to protect the following interests of the Act:

- Flood control
- Storm damage prevention
- Prevention of pollution
- Protection of fisheries, and
- Protection of wildlife habitat

The project will have no effect, positive or negative, to land containing shellfish; and whereas there are no water supplies in the project area, protection of public or private

water supply and protection of ground water supply are not considered to be applicable. The following paragraphs discuss the five interests listed above.

Flood Control and Storm Damage Prevention

The flood control and storm damage prevention capacity of the Muddy River will be enhanced by dredging and removal of *Phragmites* from the river channel, especially where expanded *Phragmites* stands have reduced the channel cross-sectional width. As documented in the DEIR dredging will increase the carrying capacity of the river resulting in the reduced flood levels and subsequent reduction of flood damage to public and private property. This is a basic goal of this project.

Pollution Prevention

Bank-to-bank dredging and the resulting removal of *Phragmites* will protect and enhance the interest of pollution prevention. Section 3.4.2 of this FEIR describes the existing quality of Muddy River sediment. The sediments in the river are documented to contain elevated levels of metals, PAHs, and petroleum hydrocarbons, with PCBs and DDT (and its metabolites) also found frequently. Contaminant concentrations were observed to be higher in surface sediment and to decline with depth (USACE, 2002 unpublished). A certain amount of sediment is re-suspended during storm events due to increased water flow velocities, thus transporting pollution from one section of the river to downstream areas, and ultimately to the Charles River. Removing contaminated sediment from the riverbed will remove this contamination source and prevent the continued transport of pollution throughout the river which ultimately discharges to the Charles River. Therefore, it is presumed to improve the pollution prevention interest by removing a pollution source present in the river channel.

Protection of Fisheries and Wildlife Habitat

Wildlife habitat will be protected through the removal of sediment in bank-to-bank dredging. As described in Section 3.4.2 of this FEIR and Appendix D to the Muddy River Boston and Brookline, Massachusetts Draft Decision Document and Environmental Assessment presents the Sediment Quality and Ecological Risk Evaluation (USACE, 2002, unpublished), the river sediments are considered toxic to aquatic organisms. That assessment utilized multiple lines of evidence to evaluate the Muddy River sediment quality and potential affects to aquatic organisms.

Sediment is likely to adversely effect benthic organisms and fish at all stations except Wards Pond, based on comparison of river sediment data to sediment quality guidelines and bioassay test results. Food chain modeling identified a risk to avian populations at all stations. The Riverway and Back Bay Fens sediment have the highest concentrations of PCBs and the greatest bioaccumulation of PCBs in fish. Consequently, risk to piscivorous wildlife is highest to animals that feed in these two river segments. Risks are also present for insectivorous birds, feeding on insects that emerge from aquatic larval life stages.

The proposed dredging and replanting of the riparian zone with a more structurally diverse community with increased species diversity comprised of native plantings will improve fisheries and wildlife habitat interests, respectively. Removal of

contaminated sediments from the river ecosystem will expose clean native sediments, or at worst, less contaminated anthropogenicly impacted sediments, thus reducing the adverse impacts to benthic invertebrates and subsequent bioaccumulation and magnification up the food chain. Newly exposed (post-dredging) sediment contaminant levels in most river segments will be significantly lower than existing surface sediment contaminant concentrations (USACE, 2002 unpublished) based on analysis of sediment cores collected at varying depths below the surface. This will result in lower hazard quotients for COPCs in the future compared to existing conditions. Improved sediment quality is expected to improve conditions for benthic invertebrate survival, growth and reproduction resulting in improved food resources for fishes as well as insectivores wildlife (wildlife feeding on insects that emerge from aquatic larval life stages). In the Back Bay Fens, hazard quotients for mercury increase slightly due to lower total organic carbon, although mercury concentrations decrease with depth. Lower total organic carbon increases bioavailability of mercury. It was noted that several conservative assumptions were included in development of the food chain model which may overstate potential risk, such that actual risk may not increase for mercury. No such phenomenon is anticipated for sediments in the Riverway section and Leverett Pond, post dredging risk from sediment contamination is reduced in these stretches of the river compared to existing conditions.

The existing riparian zone is dominated by *Phragmites* and/or maintained lawn areas with only a few trees or shrubs present in the Back Bay Fens project sub-area. Throughout the Riverway the riparian zone is characterized as a narrow fringe of lawn along the river, bisected by the old carriage paths (now used as walking paths). Beyond the fringing lawn are roadways and, in sections, trolley tracks. Trees are scattered throughout the ribbon of lawn along with scattered patches of shrubs. Much of the open space around Leverett Pond is open lawn area with trees and shrub masses scattered throughout. These conditions provide limited wildlife habitat along the river corridor.

The proposed riparian zone planting plan utilizes native plants (trees, shrubs and herbaceous plants) to replace *Phragmites* and lawn areas resulting in improved structural and species diversity. Increased structural and species diversity will improve the wildlife habitat capacity (Pianka, 1983) of the riparian corridor compared to existing conditions.

4.3.1.2 Olmsted Park

The work in the Olmsted Park will include dredging the three ponds – Leverett Pond, Willow Pond and Wards Pond – to restore the ponds to their historic depths and restore the intended natural habitats of each. This work will improve the capacity of these ponds to protect the following interests of the Act:

- Prevention of pollution,
- Protection of fisheries, and
- Protection of wildlife habitat

The project will have no effect, positive or negative to flood control, storm damage prevention, to land containing shellfish; and whereas there are no water supplies in the project area, protection of public or private water supply and protection of ground water supply are not considered to be applicable. The following paragraphs discuss the three interests listed above.

Pollution Prevention
Dredging the three ponds within Olmsted Park will remove the accumulated sediment from each pond to restore the original Olmsted design. Section 3.4.2 of this FEIR describes the existing quality of Muddy River and Pond sediments. It was reported that sediments in the river and ponds, except Wards Pond, are contaminated to levels that are deleterious to benthic invertebrates and fish (USACE, 2002, unpublished). A certain amount of sediment is re-suspended during storm events due to increased water flow velocities, thus transporting pollution from the ponds downstream to the other river sections. Removing contaminated sediment from the ponds will remove this contamination source and prevent the continued transport of pollution throughout the river which ultimately discharges to the Charles River. Therefore, it is presumed to improve the pollution prevention interest by removing a pollution source present in the river channel.

Protection of Fisheries and Wildlife Habitat
Fisheries and wildlife habitat will be protected through the removal of sediment via dredging. As described in Section 3.4.2 of this FEIR and Appendix D to the Muddy River Boston and Brookline, Massachusetts Draft Decision Document and Environmental Assessment presents the Sediment Quality and Ecological Risk Evaluation (USACE, 2002, unpublished), the river and pond sediments, except for Wards Pond, are considered toxic to aquatic organisms. That assessment utilized multiple lines of evidence to evaluate sediment quality and potential affects to aquatic organisms.

As described above in Section 3.4.2 and 4.3.1.1, sediment is likely to adversely effect benthic organisms and fish at all stations except Wards Pond, based on comparison of river sediment data to sediment quality guidelines and bioassay test results. Removal of these sediments will improve the benthic habitat and coincidently improve conditions for fishes present in the ponds. Improved benthic habitat will improve conditions for the reproduction, survival and growth of invertebrates, a food source for some fishes found in these ponds. Also, contaminated sediment can adversely effect the success of demersal eggs adversely effecting fishes populations. Removal of contaminated sediment may improve the populations of fishes present in the ponds.

Willow Pond, in particular has become so filled with sediment that the water depth is only about two feet deep across the pond, such that the aquatic habitat is nearly nonexistent. Dredging this pond to restore pond depths to six to eight feet deep, restoring the aquatic habitat of Willow Pond, and allowing fish populations in the pond to rebound.

Food chain modeling identified a risk to avian populations at all stations. Risks are identified for insectivorous birds, feeding on insects that emerge from aquatic larval

life stages. Therefore, dredging the ponds will remove this risk to avifauna that feed on organisms which inhabit Leverett and Willow Ponds.

The proposed planting plan utilizes native plants (trees, shrubs and herbaceous plants) to restore the Olmsted Park to its designed condition. This will improve structural and species diversity within Olmsted Park. Leverett Pond in particular has decreased wildlife habitat value due to the lawn areas that extend to the shoreline. Increased structural and species diversity will improve the wildlife habitat capacity (Pianka, 1983) of the park compared to existing conditions.

4.3.2 In-Stream Sedimentation Basins

Eight in-stream sedimentation basins are proposed – three in the Back Bay Fens area and three in the Riverway area and one each in Leverett Pond and Willow Pond, as described in Sections 3.4.1.2 and 3.4.1.3 of this Final EIR. These basins are proposed to be permitted pursuant to the limited project regulations 310 CMR 10.53(4) as part of the overall dredging activities as described above. The DEP has questioned the ability of these basins to meet the criteria for permitting via 10.53(4). Construction of the in-stream basins appear to meet criteria of section 10.53(4) of the Regulations because they will improve the pollution prevention capacity of the river, while not adversely affecting the other applicable interests of the Act.

The purpose of these sediment basins is to provide a basin to collect sediment conveyed to and through the river, and to prevent it from being dispersed throughout the river channel and building up in the channel.

Sediment can settle out in the in-stream basins because the larger channel cross-sectional capacity at these locations can convey the same flow rate at a reduced velocity compared to a narrower or shallower stretch of the river. Flow rate is a unit of volume per time (e.g., cubic feet per second [cfs]), a channel cross section is measured in area (e.g., square feet), thus, dividing flow rate by the channel area yields flow velocity (e.g., feet per second). Therefore, the water velocity changes as water moves through the river depending upon the channel cross sectional area for a constant flow rate. Construction of the in-stream basins will increase the channel area, resulting in reduced water velocity through the in-stream basins. Reduced water velocity allows sediment to settle out of the water column rather than to remain in suspension. The basins have been strategically placed to settle out suspended solids to reduce flow velocity and trap sediment.

Urban runoff is documented to contain contaminants either adsorbed or absorbed to sediment particles. Trapping the sediment in specified locations will prevent the transport of polluted sediment throughout the river which ultimately discharges to the Charles River. In the future, smaller scale dredging projects can be implemented to remove the accumulated sediment from these discrete traps and avoid the need for a large-scale project to remove sediment from the entire river. Therefore, this project element is proposed to improve the capacity of Land Under a Waterway to prevent the widespread distribution of pollution conveyed with sediment contained in runoff, while having no adverse effects to the other interests of the Act.

Land Under a Waterway is presumed significant to protection of public or private water supply, protection of groundwater supply, flood control, storm damage prevention, prevention of pollution, protection of fisheries, and protection of wildlife habitat. Due to the location of the Muddy River and lack of water supplies in or adjacent to the river, this resource area is not significant to protection of public or private water supply or protection of groundwater supply.

The overall dredging project is designed to improve the capacity of the river to provide flood control, storm damage prevention. These basins will neither further improve nor diminish the improvement provided by the dredging project and are therefore considered to have a neutral impact on these two interests.

Prevention of Pollution

This project element will improve the prevention of pollution function of the river as described above by removing a source of pollution present in the river, as well as by trapping sediment carried to the river from urban runoff in discrete areas of the river to prevent the transport of pollution (sediment from urban runoff) throughout the river corridor. The project includes the development and implementation of a watershed BMP plan to reduce the sediment load to the river from the tributary area. This will be implemented and will decrease the volume of sediment conveyed to the river compared to historic and existing sediment loadings. However, sediment will continue to be conveyed to the river with urban runoff. The in-stream sediment traps will augment the BMP program to trap sediment that is conveyed to the river via point and non-point sources, and to reduce the transport of sediment throughout the river channel.

Seven of the basins are proposed downstream from drainage outlets that discharge flow to the river. These basins are sited to collect sediment conveyed in runoff to prevent it from being transported throughout the river. Near the Back Bay Yard, the basin is proposed at the culvert inlet to trap sediment before it enters the culvert to prevent sediment accumulation within the culverts. The ACOE has constructed a sedimentation basin, or trap, similar in function to those proposed for this project. A concrete basin was constructed in the stream and immediately upstream of the culvert inlet to the Town River in Quincy, MA. The purpose of that sedimentation basin or trap is to prevent sediment from accumulating in the downstream culvert since it would be more difficult to remove sediment from the culvert than the trap. The ACOE reports that the trap is working well and preventing sediment from collecting in the culvert.

In preliminary discussions with the ACOE we have determined that in-stream sedimentation basins are an important element of the project. This justification not only includes the environmental benefits of the basins by controlling pollutant levels in the river, but they are included as a critical maintenance element. The ACOE will require the Proponents to accept a maintenance agreement as a condition of funding the project. They have indicated that they consider the in-stream sedimentation basins as a key element in future maintenance. Interim dredging within the basins

would lessen future impacts from a major dredging program in the future and maintain the capacity of the flow channel.

Protection of Fisheries
No adverse impact to fisheries is anticipated as a result of the in-stream sediment basins. Water depths in the Riverway section of the Muddy River range in depth from two to four feet. The proposed dredging project will increase water depths to 6 to 8 feet. At the proposed in-stream sediment basins, water depths will range from 8 to 10 feet. The DEIR documented the presence of warm water fish species in the Back Bay Fens area including Red Fin Pickerel, Brown Bullhead, Yellow Bullhead, Common Carp, Goldfish, Golden Shiner and Pumpkin Seed. These warm water fish species are often found in shallow ponds and slow moving rivers in the Commonwealth. Dredging to the proposed sediment basins depths is within the normal depth ranges for these fishes. As documented by the Corps (USACE, 2002 unpublished) in general, sediment contamination decreases with depth and therefore the sediment exposed in the in-stream basins (if not native material) will typically be less contaminated than other parts of the river not dredged to native material.

4.4 Wetlands Protection Act Variance Provisions

4.4.1 Overview

In the event the issuing the authority does not agree with the use of section 10.53(4) for dredging the in-stream sedimentation basins, the construction of the basins would meet the standards for issuance of a variance, as follows:

1) The basins will serve an overriding local, regional or national public interest,
2) There are no other reasonable alternatives to the proposed basins, and
3) That mitigating measures are proposed to protect wetland interests.

The purpose of the in-stream sedimentation basins is to trap sediment conveyed to the river from tributary drainage systems and sediment from bank erosion. Trapping the sediment in discrete locations will prevent the transport of sediment throughout the river channel affording a variety of benefits to the river.

The proposed in-stream sedimentation basins are a key component to the pollution prevention aspect of this project, as described above. In addition to trapping sediment to prevent conveyance of sediment throughout the channel, the basins will increase the project's "life span."

4.4.2 Overriding Local and Regional Interests

The Muddy River Flood Control, Water Quality and Habitat Enhancement, and Historic Preservation Project is a regional project which will improve a public resource located in two different communities and used by millions of residents and visitors each year. This project is proposed by the Boston Parks and Recreation Department and the Town of Brookline, with additional project support offered by the Boston Water and Sewer Commission, Boston PWD, Brookline DPW, the Metropolitan District Commission, the Executive Office of Environmental Affairs,

Department of Environmental Management, Massachusetts Emergency Management Agency, Federal Emergency Management Agency, Housing and Urban Development, and the U.S. Army Corps of Engineers. The consortium of organizations behind this project underscores the local and regional interest of this project.

The overall project goals include flood control, water quality and wildlife enhancement, and historic rehabilitation and preservation of the Emerald Necklace. The October 1996 and June 1998 storms caused millions of dollars of damage to public and private property. The MBTA Green Line Kenmore Square Station was completely flooded and flooding extended to the Symphony and Arlington Stations and tunnels in between. This flooding disrupted transit service for the 200,000 plus daily riders of this trolley line until needed repairs were completed. Basement flooding occurred in Brookline homes, area universities and at the Museum of Fine Arts where rare artwork is stored. Furthermore, these flood events nearly closed the neonatal care facilities at Children's Hospital.

Water quality and aquatic habitat improvements to the Muddy River will result via the removal of contaminated sediment and implementation of the proposed storm water BMP plan to reduce the volume of sediment and floatable contamination conveyed to the river.

Maintenance of the in-stream basins will require periodic small-scale maintenance dredging as part of the BMP management plan, to ensure these features function properly. Financially, these basins will expand the life span of this project and can minimize the costs needed to maintain the flood control improvements resulting from this project compared to eliminating the in-steam sedimentation basins.

The goal of the BMP program is to reduce the discharge of sediment to the Muddy River by 30 percent from the current estimate of 2,500 cubic yards per year to 1,750 cubic yards per year. Based on an average between the current rate and the new rate, the river would lose the flood flow capacity restored by this project over the next 70 years, and would need to be dredged again to restore the river's carrying capacity and flood control functions restored by this project. If the sedimentation basins are constructed, removing a total of 21,150 cubic yards from the entire Muddy River, it would take an additional 10 years at the average deposition rate to fill the basins extending the project life to 80 years, without maintenance dredging. The expected costs for a full dredging project would be similar to this project (plus an adjustment for inflation). Periodic maintenance dredging of the in-stream basins would extend the life of this dredging project beyond the 80-year period predicted above.

Back Bay Fens

The current project involves removal of 80,000 cubic yards (not including the in-stream sedimentation basins) of sediment from the Back Bay Fens, approximately 40 percent of the total project (165,000 cubic yards, not including *Phragmites* removal), and will cost approximately $23.68 million of taxpayer money for the design, permitting and implementation of this project. Ongoing operations and maintenance of the BMPs and landscaping improvements will carry additional costs.

The Riverway
The current project involves removal of approximately 18,400 cubic yards (not including in-stream sedimentation basins) of sediment from the Riverway, approximately 11 percent of the total project. The cost for Riverway dredging is approximately $4.27 million. Ongoing operations and maintenance of the BMPs and landscaping improvements will carry additional costs.

4.4.3 No Other Reasonable Alternatives

The in-stream basins are designed to trap sediment carried in runoff as well as sediment conveyed to the river via non-point sources to prevent it from being distributed along the entire riverbed. Other alternatives to trap sediment prior to discharge to the river include construction of sedimentation basins outside of the river (i.e. along the river banks) or construction of large underground storage tanks. These options would collect sediment conveyed in the drainage system but would not trap sediment from non-point sources. These two alternatives have significant drawbacks as described below.

The Muddy River flows through the Emerald Necklace. Another major component of this project is the restoration and preservation of the Emerald Necklace designed by Fredrick Law Olmsted, Sr. Construction of sedimentation basins along the river and within parks and gardens along the riverbank is not in keeping with the original Olmsted design and would not be permitted by the historic regulatory agencies. Furthermore, basins along the river would usurp space currently used for, and most suitable for, public enjoyment. Because construction of sedimentation basins along the river's banks is 1) contrary to other project goals, and 2) would remove existing public open space from public use, this alternative was rejected from further consideration.

Underground storage tanks, or particle separators, are not practicable for two related reasons, cost and constructability. Construction of underground tanks and restoration of the surface to the Olmsted Plan are significantly more expensive than the small incremental added cost of dredging the in-stream sediment basins during the overall dredging project. A present worth comparison over 25-years indicates the in-stream basins are less than half the cost of particle separators (similar to storage tanks) a per cubic yards (CY) of sediment removed basis, as described below.

Using the cost information on Table 5-10 in the Draft EIR, the cost to dredge the sedimentation basins not including the basins with hazardous materials was estimated at $4,942,000. The total cubic yards in those basins not including the ones with hazardous materials is 17,717 CY. A division yields a cost of $278 per cubic yard. This is basically a capital cost per cubic yard.

A typical particle separator costing $100,000 would yield about 10 CY per year. The yield over 10 years, which is the life of the sedimentation basins, would be 100 CYs. A division yields $1,000 per cubic yard for capital costs for particle separators.

A more realistic basis to compare these alternatives would be a present worth cost. Using a discount rate of 6.125% and a project life of 25 years yields the following. Sedimentation costs would be $4,942,000 in year 0, plus the same cost discounted in year 10 and half the cost discounted in year 20. This would be the cost of re-dredging the system to provide capacity for 25 years. The basin capacity is about 10 years for the estimated deposition rate. Based on the total cubic yards removed (44,293) the present worth cost per cubic yard would be $190 per CY.

In calculating the present worth cost of a particle separator, we used a separator sufficiently large to remove about 10 CYs of sediment per year based on two cleanouts per year, using the BWSC average cleanout cost of $270 per cleanout or $540 per year. The present value per cubic yard for the particle separator would be $426 per cubic yard, or more than double the per cubic yard cost of the sedimentation basins. Presented in another way, it would require nearly $18,000,000 in particle separator capital costs to remove an equivalent number of cubic yards of sediment by the in-stream basins over 25 years.

Construction of detention basins or tanks along the Muddy River would require a significant amount of surface area adjacent to the River and remove available open space from public use within the Emerald Necklace. There are sixteen drainage outlets that discharge storm flows to the Muddy River. The subwatersheds tributary to these outlets range in size from 2.5 acres to 986 acres, with an average watershed size of 234 acres.

Using the Daisy Field subwatershed as an example, preliminary calculations were performed to size a representative detention basin/tank to treat design flows that currently discharge from the Daisy Field drain. The subwatershed tributary to the Daisy Field drain is approximately 80 acres, about 1/3 the size of the average subwatershed in the Muddy River basin. Construction of a detention basin or tank for the Daisy Field drain would require a structure of approximately 10,550 square feet by 5 feet deep to treat the water quality volume of ½-inch of runoff from the impervious surface cover of this subwatershed. A basin of this size would result in dimensions of approximately 100 feet by 100 feet for a square basin, or 50 feet by 200 feet for a rectangular basin.

Basins to treat larger watersheds would be significantly larger to treat the water quality volume used in this example. An example of a large detention basin/tank would be one that is sized to treat flows from the Longwood Avenue drain. The subwatershed tributary to this drain is approximately 250 acres. In order to treat the ½-inch of runoff from this subwatershed, a detention basin/tank of approximately 36,000 square feet (about 8/10ths of an acre) would be required. Constructing detention basins or tanks of these proportions would be impracticable along the Muddy River.

Furthermore, in the Back Bay Fens river segment, the urban area in which these tanks or basins would need to be built (in the vicinity of Boston Gatehouses and Avenue Louis Pasteur) contains several underground utilities which would need to be relocated to accommodate large storage tanks or basins. This situation makes

construction very difficult and extremely expensive. In addition, supplemental storage of runoff, either in detention basins or underground storage tanks, does not provide a trap for sediment conveyed to the river by bank erosion, other non-point source discharges, or from drainage systems which are not routed through particle separators. Therefore, they could not trap or collect sediment from these other sediment sources.

The Riverway is essentially a long narrow corridor along the river bounded by secondary roadways on either side of the river corridor. There is insufficient space to construct suitably sized basins within this narrow park along the river.

These alternatives were not considered beyond the preliminary planning stage because they are more costly, more difficult to construct and less efficient than in-stream basins, as described above.

4.4.4 Mitigating Measures Provided

The project purpose is several fold, with a major project goal being to improve the flood control and storm damage prevention functions of the Muddy River, as well as to preserve the other interests of the Act. The project is proposed to mitigate flooding along the river during extreme storms, such as the October 1996 storm. In this way the project is itself a mitigation measure. The project as proposed is designed to protect the interests of the Act. The in-stream sedimentation basins, as described above, serve to protect the pollution prevention interest, with no adverse effects to other applicable interests of the Act. Measures are proposed for the construction phase to avoid and mitigate construction impacts to the river. However, once dredging of the in-stream basins is completed no additional mitigation measures are warranted, because no adverse impacts to the riverbed and applicable interests of the Act will be adversely affected by the presence of the basins.

4.4.4.1 Selection of Least Damaging Practicable Alternative

There are basically two alternatives available to dredge the Muddy River: mechanical dredging by excavator or clamshell or hydraulic dredging. A description of dredging techniques is presented in Section 2 of the Draft EIR. Based on the review of the various dredging techniques, hydraulic dredging was identified as the most appropriate technique throughout the project area. Hydraulic dredging avoids or greatly minimizes potential impacts associated with mechanical dredging.

Hydraulic dredging minimizes the water quality impacts associated with sediment removal and transport. The suction action collects the majority of suspended sediment generated during sediment removal, greatly reducing the transport of turbid water downstream, compared to mechanical dredging. Pumping the dredged material in enclosed pipelines avoids fall back or spills of dredged material back into the river. Fall back or spills of dredged material into the river during mechanical dredging using a bucket or clamshell is almost unavoidable. Also transport of sediment to the dewatering staging area by pipeline only requires placement and periodic relocation of the pipeline from the work area to a dewatering area. This avoids or greatly minimizes impacts to surrounding environments compared to

mechanical dewatering. Along the Muddy River, mechanical dredging would either require numerous dewatering areas within the reach of the dredging equipment, or transport of sediment by truck to fewer centralized dewatering staging areas. This alternative would require that trucks have access along nearly the entire shoreline of the river for transfer of sediment from the excavation bucket to the truck bed. This would result in excessive alteration of the riverbank compared to placement and periodic relocation of a temporary surface pipeline. Based on this summary evaluation of dredging techniques, it is apparent that the benefits (reduced impacts) of hydraulic dredging favor the selection of hydraulic dredging compared to mechanical dredging.

4.4.4.2 Construction Period Mitigating Measures

As discussed above, the first step to minimize impacts is to select the least damaging dredging technique. Use of hydraulic dredging avoids many of the potential impacts to waters and wetlands associated with mechanical dredging. Additional measures to minimize impacts during dredging are presented below:

- Deploy silt curtains with oil-absorbent booms to enclose the work area. Silt curtains will not be deployed across the river, so as to maintain a passage for fish and other aquatic organisms through the work area.

- Silt curtains and oil absorbent booms will be inspected daily and repaired as needed.

- No dredging will occur between March 15 and June 15.

- A water quality monitoring program will be developed and implemented for the duration of the in-water work. Monitoring events and parameters will include:

    1. Continuous monitoring of turbidity, both up and downstream within 200 feet of the discharge of dredge pressate;

    2. Weekly collection of water samples to be analyzed for TPH, total and dissolved lead (dissolved lead shall be less than 1.0 micrograms/l, a site-specific, chronic, water-quality criteria based on 40 mg CaCO3/l measured at the nearest sampling location);

    3. Weekly measurements of water temperature, pH, and DO;

    4. Weekly sampling of the filtrate for analysis of TSS, total and dissolved lead, and DO. To be suitable for discharge, the filtrate shall have a TSS of less than 40 mg/l, dissolved lead less than 1.0 micrograms/l above background, and a minimum DO level of 5 mg/l. The filtrate shall be discharged into the Muddy River within a silt-curtained enclosure equipped with an oil-absorbent boom; and

    5. A request for 36-hour turnaround time when samples are delivered to the lab for analysis.

- The monitoring and analytical results will be attached to the weekly Environmental Inspection Report to DEP

- Prior to the start of in-water work, any polymer proposed for use will be identified and information about its aquatic toxicity shall be forwarded to DEP

- Any oily material, as evidenced by a visible sheen, released during dredging will be promptly collected and reused or disposed of at a licensed facility

- Dewatering and reuse conditions per DEP Interim Policy Comm-94-007 and Comm-97-001 will be followed

- All disturbed or exposed soil surfaces will be temporarily stabilized within 30 days of disturbance or exposure, with hay, straw, mulch or any other protective covering and/or method approved by the U.S. Department of Agriculture, Natural Resource Conservation Service, to prevent erosion.

4.5 Water Quality Certification Compliance

4.5.1 Overview

Project elements subject to DEP jurisdiction pursuant to the WQC Regulations include the dredging activities in the river below ordinary high water, as well as any excavation or grading in jurisdictional wetlands including habitat restoration activities. The key criteria or performance standards from Section 9.06 of the regulations that are applicable to this project include:

- Selection of the least damaging practicable alternative;

- Discharges will not be permitted unless appropriate and practicable steps have been taken to minimize impacts to waters of the U.S.;

- No discharges to Outstanding Resource Waters (ORWs) are permitted except for specific circumstances specified in 9.06(3)(3);

- No discharge is permitted for the impoundment or detention of stormwater for the purpose of controlling sediment or other pollutant attenuation. Discharges may be permitted to manage stormwater for flood control purposes provided there is no other feasible alternative;

- Stormwater discharges shall be provided with the BMPS to attenuate pollutants and require a setback from waters of the U.S.; and

- No discharges will be permitted that meet the review criteria in circumstances where the discharge would result in substantial adverse impacts to surface waters of the Commonwealth.

Section 9.07 of the regulations presents the sediment classification criteria (both physical and chemical quality) of sediment, as well as dredging and DEP approved disposal methods, depending upon sediment quality and disposal location. Dredging

and sediment management is presented in Section 2 of this Final EIR. The following evaluates the dredging activities pursuant to Section 9.06 of the regulations.

4.5.2 Select Least Damaging Practicable Alternative

There are basically two alternatives available to dredge the Muddy River: mechanical dredging by excavator or clamshell, or hydraulic dredging. A description of dredging techniques is presented in Section 2 of the Draft EIR. Based on the review of the various dredging techniques, hydraulic dredging was identified as the most appropriate technique throughout the project area. Hydraulic dredging avoids or greatly minimizes potential impacts associated with mechanical dredging. See Section 4.4.4.1 above for further discussion on the selection of hydraulic dredging as the Least Damaging Practicable Alternative,

4.5.3 Steps to Minimize Impacts to Waters of the U.S.

As discussed above, in Section 4.4.4 the first step to minimize impacts is to select the least damaging dredging technique. Use of hydraulic dredging avoids many of the potential impacts to waters and wetlands associated with mechanical dredging. Additional measures to minimize impacts during dredging are presented above in Section 4.4.4.2.

4.5.4 No Discharges to Outstanding Resource Waters

This criterion is not applicable. The Muddy River is not designated as an ORW.

4.5.5 No Discharge for the Impoundment or Detention of Storm Water

The DEP has interpreted dredging of the proposed in-stream sedimentation basins as an "impoundment or detention of storm water for the purpose of controlling sediment," as indicated in their comment letter to MEPA on the Draft EIR. The proponents do not agree with this interpretation of 314 CMR 9.06(5), as discussed below.

This criterion is not applicable. Impoundment is defined as a storage area, such as a reservoir, which refers to a storage area to collect or store storm water for the purpose of controlling sediment or other pollutants. No storage of storm water is proposed for this project and the discharge of material is not proposed for construction of impoundments to store or collect storm water.

This project involves hydraulic dredging of the Muddy River to increase the capacity of the channel to convey flood flows without overtopping and flooding adjacent public and private properties. As part of this project, the proponent will develop and implement a series of stormwater management BMPs to treat stormwater to minimize the transport of sediment and other pollutants conveyed in runoff from reaching the river or being distributed throughout the river channel. To augment the BMP program excavation of in-stream sumps (or sedimentation basins) at strategic locations are proposed. These basins will trap sediment from non-point as well as point sources not rapped in upstream structural BMPS. The majority of sumps are

located at storm drain outlets, as well as other locations as shown as "overdredge area" on Figures 4-1 through 4-5 to trap sediment conveyed to the river in storm water.

To form the sumps, sediment will be removed from the river (hydraulically dredged) from the channel. These sumps will not impound (i.e. store) storm water, as the flow of river water will not be impeded or impounded at these locations. River water will flow freely through stretches of the river within which basins are dredged. The sumps will decrease the water velocity at these points by increasing the channel's cross-sectional area. Sediment can settle out in the in-stream basins (sumps) because the larger channel cross-sectional capacity at these locations can convey the same flow rate at a reduced velocity compared to a narrower or shallower stretch of the river. Flow rate is a unit of volume per time (e.g. cubic feet per second [cfs]), a channel cross section is measured in area (e.g. square feet), thus, dividing flow rate by the channel area yields flow velocity (e.g. feet per second). Therefore, for a constant flow rate, the water velocity changes as water moves through the river depending upon the channel cross sectional area. Construction of the in-stream basins will increase the channel area, resulting in reduced water velocity through the in-stream basins. Reduced water velocity allows sediment to settle out of the water column rather than to remain in suspension.

4.5.6 Provide Storm Water Discharges with BMPs

No new storm water discharges are proposed as part of this project. A BMP management plan is an important part of this project to minimize the discharge of sediment and other pollutants conveyed in storm water and discharged via existing outfalls. These BMPs are designed to trap sediment and other pollutants in the upstream structural BMPS before reaching the river and to reduce the amount of sediment from being conveyed throughout the river corridor (e.g. in-stream sedimentation basins). Please see Section 5 of this Final EIR for a thorough discussion of the storm water BMPs and management plan.

4.5.7 No Discharges are Permitted That Would Result in Substantial Adverse Impacts to Surface Waters of the Commonwealth

The project has been designed and measures to mitigate impacts have been planned to avoid adverse impacts to the physical, biological and chemical characteristics of the Muddy River. Whereas hydraulic dredging avoids, or greatly reduces the risk of redeposition of dredged material to the river, one could argue that this technique does not result in the incidental fall back of dredged material and therefore is not subject to Section 401 of the CWA, as no discharge of dredged material is anticipated.

4.6 Over-Dredging Alternatives

As described in Section 3, the purpose of these sediment basins is to provide a basin to collect sediment conveyed to and through the river, and to prevent it from being dispersed throughout the river channel and building up in the channel.

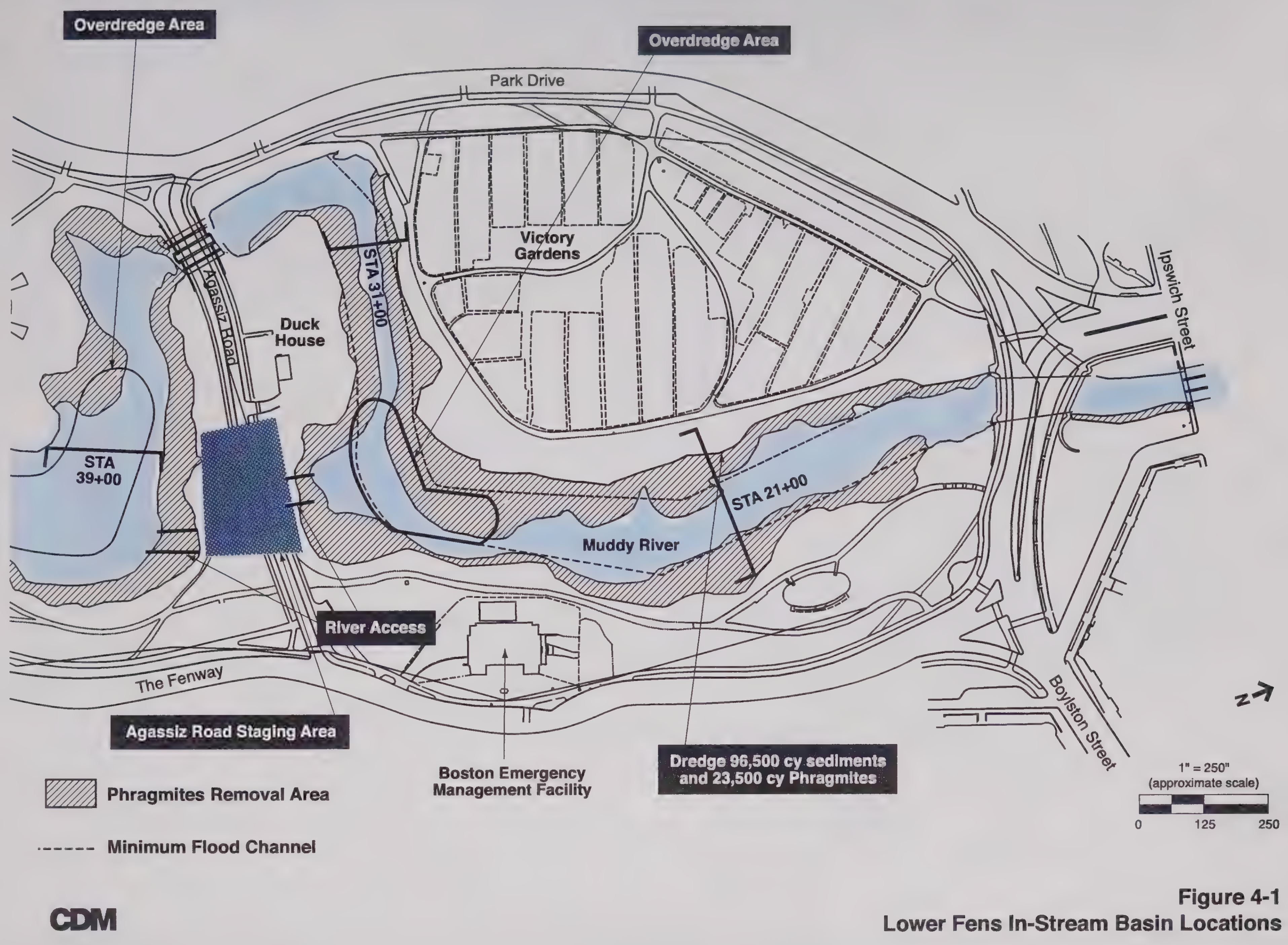

Figure 4-1
Lower Fens In-Stream Basin Locations

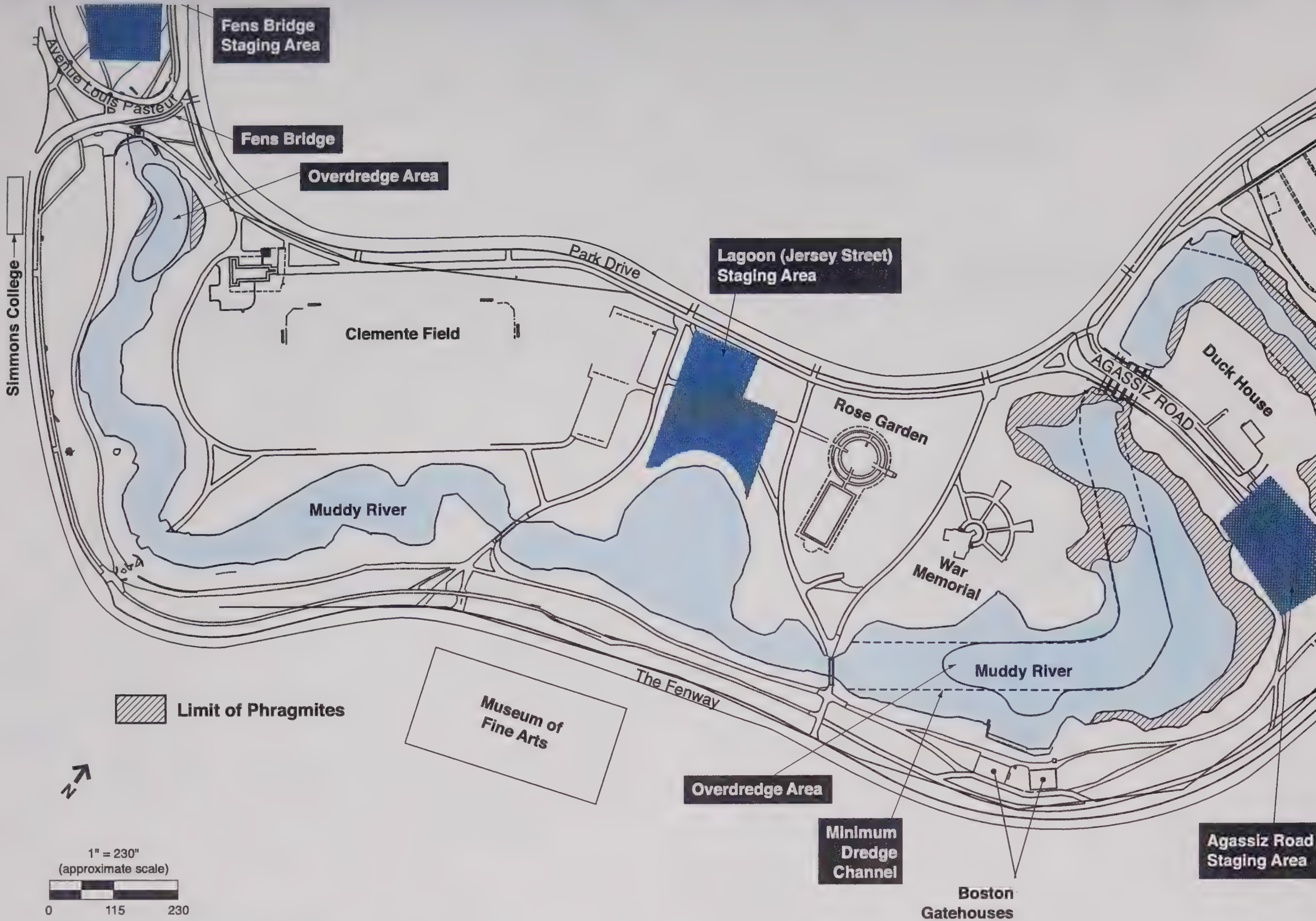

Figure 4-2
Lower Fens In-Stream Basin Location

CDM

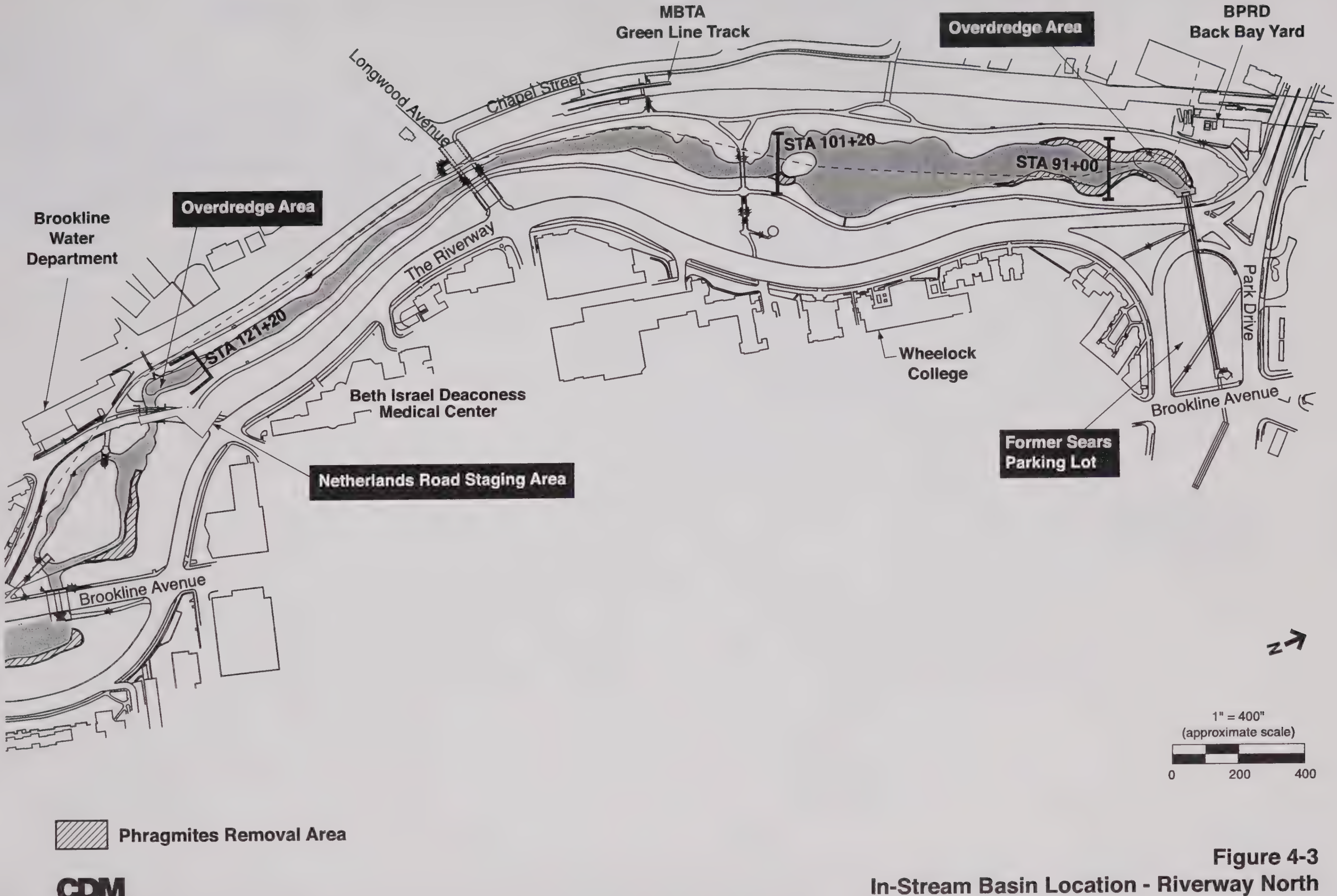

Figure 4-3
In-Stream Basin Location - Riverway North

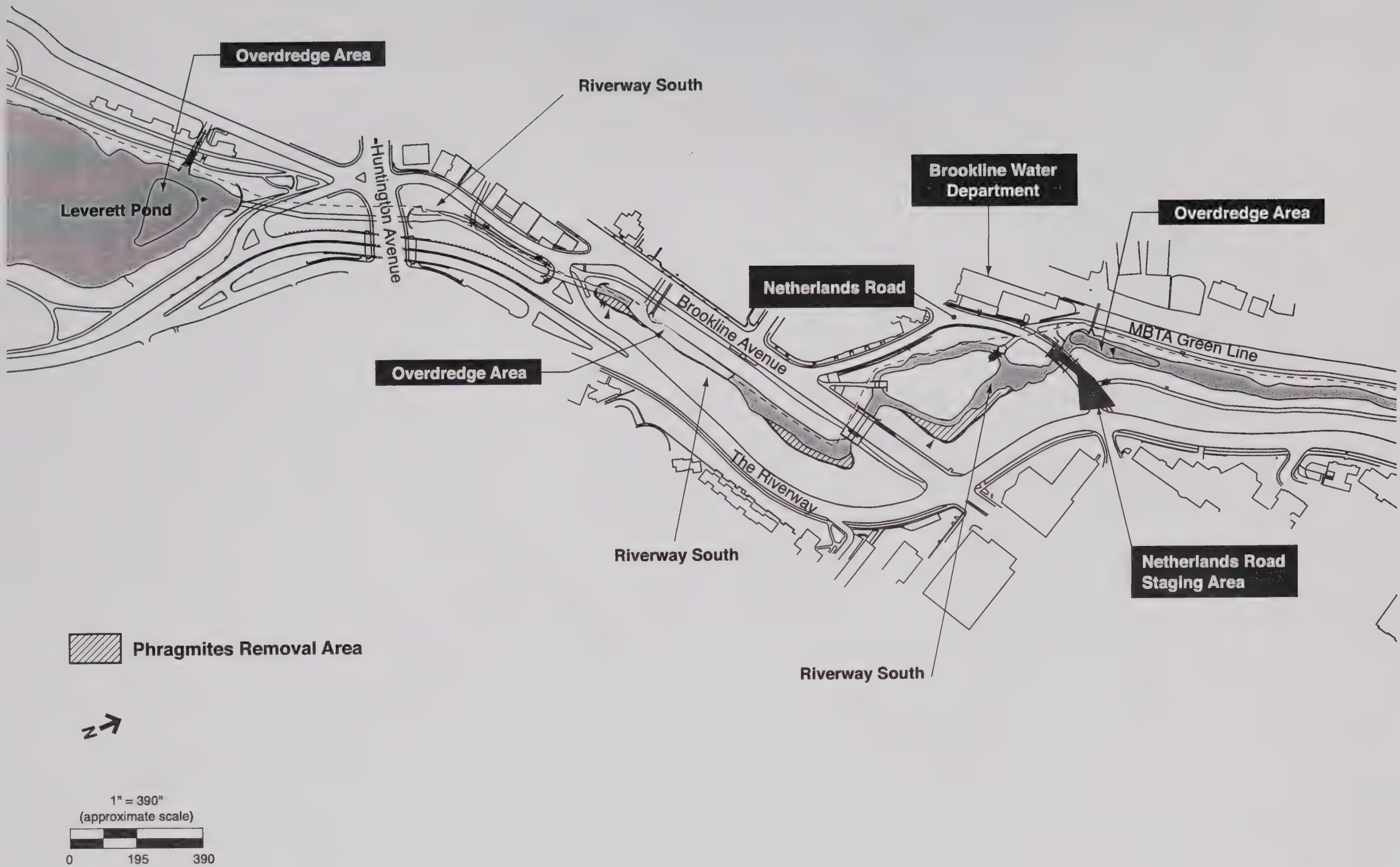

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Figure 4-4
In-Stream Basin Location - Riverway South

Figure 4-5
In-Stream Basin Location - Willow Pond

CDM

As discussed in Section 3.4.1, a total of eight in-stream sedimentation basins (or sumps) are proposed for this project. The sumps are proposed in strategic locations to trap sediment discharged with storm water at major outfalls and other areas to slow water velocity to prevent continued sediment transport. The following six sumps are proposed at outfalls:

- The Boston Gatehouses,
- Avenue Louis Pasteur (Emmanuel College Drain overflow),
- Downstream of Netherlands Road (Longwood Avenue drain),
- Between Brookline Avenue and The Riverway at Aspinwall Road (Tannery Brook drain),
- In Leverett Pond at the Village Brook Drain, and
- In Willow Pond at the Chestnut Street Drain.

The in-stream basins are proposed to augment the structural and non-structural BMPs proposed for this project. Watershed BMPs include the following:

<u>Source Control Measures</u>

- Annual water quality sampling program
- Improved street sweeping program
- Institute catch basin cleaning/tracking program
- Trail maintenance
- Water fowl control program

<u>Treatment Controls</u>

- Bioretention facility
- Dry Swale
- Underground sand filters
- Particle separators

The in-stream basins are designed to trap sediment conveyed to the river in runoff as well as non-point sources to prevent it from being distributed along the entire riverbed. Other alternatives to trap sediment prior to discharge to the river include construction of sedimentation basins outside of the river (i.e. along the river banks) or construction of large underground storage tanks. These options would collect sediment conveyed in the drainage system but would not trap sediment from non-

point sources. These two alternatives have significant drawbacks as described above in Section 4.4.3 of this Final EIR.

These alternatives were not considered beyond the preliminary planning stage because they are more costly, more difficult to construct and less efficient than in-stream basins, as described above.

4.7 Conclusion

Section 3 and 4 address the technical (Section 3) and regulatory (Section 4) issues for both the Wetlands Protect Act and Section 401 Section Water Quality Certification program as required in the Certificate on the Draft EIR. Section 3 addressed the potential impacts associated with dredging the Muddy River including bank-to-bank dredging and over dredging in specific locations to form in-stream sediment traps. It is our opinion that the material presented therein documents that the proposed dredging techniques and mitigation measures are appropriate and will adequately protect the aquatic and hydrarch environments from potential impacts, and that the proposed dredging and park land restoration project will result in no significant adverse impact to these resources.

Section 4 documents the project's ability to meet the requirements of the Wetland Protection Regulations and Water Quality Certification Regulations. Specifically we document compliance with the limited project status for wetland resource area improvements [(310 CMR 10.53(4)] and Section 9.06 of the Water Quality Certification Regulations (314 CMR 9.00). Should the issuing authorities disagree with the assessment relative to the limited project status we also document herein the project's compliance with the required performance standards needed to receive a variance from the Wetlands Protection Act in Section 4.4 of this Final EIR.

5

Section Five

Section 5
Watershed Evaluation and Best Management Practices

5.1 Introduction

The purpose of this section is to provide a plan for stormwater best management practices (BMPs) in the Muddy River watershed beyond what was included in the Draft EIR. The goal of the BMP plan for the watershed is to reduce solids loadings in the river by 30% by 2006. A reduction of 30% will expand the life of the dredging project from approximately 30-50 years to 50-70 years. This goal can be achieved by a varied plan which includes improvements to both source and treatment control BMPs. The basis of the improved plan is a basin-wide evaluation of potential structural BMPs.

This section is organized into five major subsections. The first section outlines the comments on BMPs in the Draft Environmental Impact Report. Section 5.3 outlines existing conditions in the watershed in terms of some of the major source control measures currently in place. The next section discusses the recommended plan, including both source and treatment control BMPs.

Costs of the recommended BMP plan are discussed in Section 5.5, and the maintenance plan for BMPs is included in Section 5.6.

5.2 MEPA Certificate and Draft EIR Comments

The Secretary of Environmental Affairs acknowledged in his Certificate on the Draft EIR that the BMP commitments in the Draft EIR are "a good starting point," but also noted that more can be done to protect the public investment in the project through the use of BMPs. Specifically, the following issues related to BMPs should be addressed in the Final EIR:

- An enhanced stormwater management/BMP alternative in the upstream watershed should be discussed (as part of the alternatives analysis for the Water Quality Certification);
- The Final EIR should include the results of the Charlesgate BMP work plan and should contain a BMP plan for the Muddy River Watershed that identifies specific BMPs; includes a planning, permitting, and construction schedule;
- A pilot BMP program should be implemented as soon as possible.

Other comments related to BMPs included:

- Clarify how the additional 30% TSS removal will be achieved and show the proportion assigned to each BMP;

- Incorporate results of particle separator study in Final EIR;
- Be more definite about expected success rate of basin-wide BMPs;
- Include more detailed analysis of source controls;
- Include detailed stormwater plans for the MDC and efforts that will be made by Boston and Brookline in the Muddy River drainage area (addressed in this chapter as the enhanced stormwater management and BMP program);
- Analyze additional runoff control measures for stabilizing Daisy Field and reducing runoff;
- Examine the possibility of putting swales in parklands around Leverett Pond;
- Address concerns over the maintenance of catch basins and illegal dumping of materials (addressed in Response to Comments);
- Discuss street sweeping;
- Discuss resetting and repairing curbs to stop sediments from reaching the river;
- Include regular monitoring and reporting on BMP implementation and making reporting accessible to the public (addressed in Section 6);
- Evaluate use of cisterns or other methods to reuse stormwater runoff including costs and benefits (addressed in the Response to Comments);
- Check accuracy of statements in the Draft EIR regarding illegal connections and interconnections.

5.3 Existing Conditions (Year 2000 Practices)

5.3.1 Source Control Measures

Many source control measures are already in place in the Muddy River watershed. The most significant of these, and those slated for improvements (discussed in Section 5.4.1) are catch basin cleaning, construction site controls, and street sweeping. A summary of the year 2000 practices for these BMPs follows.

5.3.1.1 Catch basin cleaning

Compared to practices in other communities, Year 2000 catch basin cleaning practices are, in general, aggressive, as shown in the following table:

Table 5-1

Year 2000 Catch Basin Cleaning Practices

Owner	Catch Basins[1]	2000 Practice
Boston	161	Varies by location, but typically once every three years
Brookline	2120	Varies by location, but typically once or twice a year
MDC	90 (est.)	Varies by location, goal of once per year
MHD[2]	83 (est.)	Once every two years
Newton	224	Varies by location, but typically once or twice a year

1) Number of catch basins in the Muddy River watershed.
2) MHD refers to Massachusetts Highway Department. All MHD catch basins in the Muddy River watershed are located along Route 9 in Brookline.

Despite the generally good practice, improvements in catch basin cleaning that will reduce annual sediment loadings are possible, and are discussed in Section 5.4.4.1.

5.3.1.2 Construction Site Controls

Uncontrolled construction sites are extreme stressors on the environment. Sediment loads from construction sites are 1,000 to 2,000 times greater than from natural green spaces. Therefore, construction site controls are essential for mitigating construction impacts on sediment loadings.

For construction sites that disturb more than five acres, EPA's NPDES Phase I Stormwater Management Program requires a stormwater management plan emphasizing erosion and sediment controls. Construction sites disturbing more than five acres are a relatively rare occurrence in the Muddy River watershed.

For construction sites subject to the Wetlands Protection Act, the Boston and Brookline Conservation Commissions regulate construction activities. The Conservation Commissions routinely require project proponents to follow Orders of Conditions that include proper erosion and sediment controls in areas within their jurisdiction.

However, there are currently no controls for construction sites disturbing less than 5 acres outside of the jurisdiction of the Boston and Brookline Conservation Commission.

5.3.1.3 Street Sweeping

Street sweeping practices in the jurisdictions covering the Muddy River watershed are summarized in Table 5-2, below.

Table 5-2

Year 2000 Street Sweeping Practices

Owner	2000 Practice
Boston[1]	Commercial areas once a week, Remaining areas once a month, April 1 – November 30
Brookline	Commercial areas every night Remaining areas, once a week
MDC	Varies by street based on need
MHD	Annually in the spring
Newton	Once a week

[1] Actual street sweeping practices vary across the City.

The benefit of street sweeping is significant for the watershed. The EPA Phase II Stormwater Program "awards" a 10 percent reduction in TSS loadings for good street sweeping programs.

5.3.2 Stony Brook Conduit

The Stony Brook Conduit is one of the major features of the metropolitan Boston drainage system, and has a direct impact on the hydraulics and water quality of the Muddy River.

A schematic showing key features of the Stony Brook Sewer System and the Muddy River is shown in Figure 5-1. The Stony Brook Conduit (SBC) is a 7-mile long storm drain extending from the Stony Brook Reservation to Boston Gatehouse No. 1 (BGH#1) on the banks of the Muddy River. It serves a 13 square mile area, more than twice the size of the Muddy River watershed. Of the 13 square miles, the upper 10 square mile area has a separate sewerage system, while the remaining lower area of Stony Brook has a combined sewer system.

During dry weather, the SBC conveys brook flow from the separated portion of the drainage area located in Jamaica Plain, Roslindale, West Roxbury, and Hyde Park, including Bussey Brook, Canterbury Brook, and Goldsmith Brook as well as Stony Brook. During wet weather, combined sewer overflows from the lower combined portion of the basin mix with the brook flow and stormwater from the upper drainage area.

Throughout most of its length, the SBC is a single pipe. However, near the intersection of Parker and Prentiss Streets, the SBC splits into two large drains, the Commissioners Channels, for a distance of about 2,000 feet. Then it reverts to a single 700-foot long drain at BGH#1. BGH#1 is located along the banks of the Back Bay Fens at Rose Garden Pond.

At BGH#1 the flow from the SBC is discharged to the 12-foot Foul Flow Conduit. This conduit carries the flow from BGH#1 to the MWRA's Charlesgate East Gatehouse which discharges through two outfalls to the Charles River. BGH #1

Figure 5-1
Stony Brook System Schematic Including Muddy River

CDM

contains sluice gates that when overtopped or opened by the Commission personnel allow discharge to the Muddy River. This rarely occurs, perhaps a few times annually, usually during large storm events in the spring or fall when the gates are opened to prevent upstream flooding.

BGH#2, adjacent to BGH#1, serves the Old Stony Brook Conduit Combined System. This system is completely isolated from the Stony Brook System. The gates that would divert flow to the Muddy River are no longer operational. BGH#2 directs flow from the Old Stony Brook Conduit system by the MWRA Gatehouse, to the interceptor system, then to the MWRA's Prison Point CSO facility. Dry weather flows at Prison Point are pumped to the Deer Island Wastewater Treatment Plant. Wet weather flows are screened and disinfected, then discharged to the Charles River.

BWSC is currently undertaking a project to rehabilitate the Back Bay Fens Gatehouses. The total project cost, including planning, design and construction, is estimated at $2.6 million. The project is likely to be completed before the Muddy River Restoration project in the Back Bay Fens begins. Three of the existing sluice gates in BGH #1 will be replaced with new cast iron sluice gates. The fourth gate in BGH #1 will be sealed in place to act as a fixed weir in the unlikely event overflows are necessary.

5.3.3 Treatment Control Measures

Existing treatment control measures in the Muddy River watershed include both public and privately owned and maintained treatment control measures. For the purposes of this study only existing publicly owned and maintained treatment control measures are discussed in this section.

There are currently five particle separators in place in various locations in the Muddy River watershed. Of these five, two are owned and maintained by the Town of Brookline, one is owned and maintained by BWSC, one is owned by the Boston Parks Department , and one is owned and maintained by the MDC. Table 5-3 provides detail on the location of each of the particle separators, drainage area and design flow. In total, the five existing particle separators treat a drainage area of approximately 190 acres, or five percent of the watershed.

Table 5-3

Existing Particle Separators in the Muddy River Watershed.

Location	***Ownership***	***Drainage Area***	***Design Flow Capacity***
Parking lot near Walnut Street, near intersection with High Street , Brookline	Brookline DPW	30	25 cfs
Cypress Street, approx. 50 feet east of intersection with Franklin Street, Brookline	Brookline DPW	85	12 cfs
Intersection of Perkins Street and Parkman Drive, adjacent to Jamaica Pond, Boston	Boston Parks Department	20 acres	11 cfs
Fenwood Road, approx. 50 feet from intersection with Brookline Avenue, Boston	BWSC	30 acres	No info
Jamaicaway	MDC	No info	No info

A pilot program on particle separators is currently being conducted by the project proponents to evaluate the effectiveness and removal rates of the existing units. Four particle separators are included in this pilot program, including the particle separators owned by BWSC and Brookline. The pilot program includes a monitoring plan for up to 12 storm events, 3 during each season, and an assessment of the effectiveness of each particle separator. The monitoring program includes the following:

- Collection of flow measurements
- Collection of discrete grab samples of inflow and outflow and analyze for TSS and Oil and Grease.

The actual effectiveness of the existing treatment control measures in reducing solids loading to the Muddy River is unknown. Results of the ongoing pilot program will be used to develop design criteria (sizing, layout and removal effectiveness) for structural BMPs to ensure that additional particle separators recommended for the watershed are properly sized and maintained.

5.3.4 Existing Sediment Loadings

Existing sediment loadings in the Muddy River watershed need to be estimated so that control strategies can be evaluated for reducing this load. Sediment loadings are

defined as the amount of material that runs off the watershed during rainfall events and accumulates as sediment in the river. The basic methodology as described below is to use a Watershed Management Model to calculated sediment loads based on the land use types in the watershed.

5.3.4.1 Water Management Model (WMM)

The Watershed Management Model (WMM) calculates pollutant loads within a watershed on an annual or seasonal basis. User defined entry data in WMM includes stormwater event mean concentrations (EMCs), land use, average annual precipitation, annual baseflow and average baseflow concentrations point source flows and pollutant concentrations. The model estimates annual storm water runoff pollution loads and concentrations based on event mean concentrations, land use, percent impervious, and annual rainfall. WMM also estimates stormwater runoff pollution load reduction due to partial or full-scale implementation of onsite or regional best management practices (BMPs), including both structural and nonstructural controls.

The event mean concentration is a flow-weighted average concentration for a storm event and is defined as the sum of individual measurements of storm water pollution loads divided by the storm runoff volume. (EPA, Rouge River Reference). The EMC is widely used as the primary statistic for evaluations of stormwater quality data and is the stormwater pollutant loading factor in analyses of pollutant loadings to receiving waters. Runoff volumes are computed for each land use category based on the percent impervious of the land use and the annual rainfall. The runoff volumes are multiplied by land use specific mean EMC load factors (mg/L) to obtain nonpoint pollutant loads by land use category.

Table 5-4

TSS Mean EMC Values and % Impervious for Muddy River Land Use

Land Use Type	*TSS EMC (mg/L)*	*% Impervious*
Agriculture/Pasture	415	0.5
Commercial	175	80
Forest/Rural Open	415	0.5
High Density Residential	269	65
Medium Density Residential	269	38
Medium Density Residential/Institutional	269	38
Low Density Residential	269	20
Industrial	175	72
Highway	273	90
Office/Light Industrial	175	65
Parking Lot	273	95
Transportation	273	80
Private Road	273	85
Urban Open	415	0.5

Wetland	415	5
Water	50	100

To convert event mean concentrations of TSS to annual loads, nonpoint pollution loading factors are used. WMM nonpoint pollution loading factors vary by land use and percent impervious of each land use. For each land use, M_L, the pollution loading factor in pounds per year is calculated using the following equation:

$M_L = EMC_L * R_L * K * A_L$ Equation 5-1

Where M_L is the loading factor for land use L in pounds per year, EMC_L is the event mean concentration of runoff from land use L in milligrams per liter, A_L is the area of land use L in acres, K is equal to 0.2266, a unit conversion constant, and R_L is the total average annual surface runoff from land use L in inches per year. R_L is computed using equation 5-2 below,

$R_L = [C_P + (C_I - C_P) IMP_L] * I$ Equation 5-2

Where R_L is the total average annual surface runoff from land use L in inches per year. IMP_L is the fractional imperviousness of land use L from Table 5-4, I is the long-term average annual precipitation in inches per year. C_P is the pervious area runoff coefficient, 0.20, and C_I is the impervious area runoff coefficient, 0.95. For the Boston area, the long-term average annual precipitation is 41 inches per year (NOAA, 2000).

5.3.4.2 Calculation of Existing Loadings

Existing total suspended solids loadings (TSS) for the Muddy River watershed were calculated using the methodology described in the equations 5-1 and 5-2. For the base conditions model, the annual load to the Muddy River was calculated to be 2500 cubic yards per year. A 30% reduction, or a reduction of 750 cubic yards per year can be achieved by the recommended plan discussed in the following section.

5.4 Recommended Plan (Year 2006 Recommendations)

The purpose of this section is to outline and describe the recommended plan to control sediments to be in place by 2006. The first part describes source control recommendations (i.e. increasing frequency and effectiveness of existing practices), while Section 5.4.2 discusses improvements that have been made to the Stony Brook Conduit. The final two sections discuss evaluation of specific sites for structural BMPs, including those sites previously listed in the Center for Watershed Protection's 1999 Charles River Basin Retrofit Inventory, suggested modifications to those sites and a plan for installing particle separators.

5.4.1 Source Control Recommendations

The primary source control measures were listed in Table 5-7 of the DEIR. Basin-wide source control measures and associated monitoring included in DEIR include:

- Annual water quality sampling program

- Improved street sweeping program
- Institute catch basin cleaning/tracking
- Trail maintenance
- Public education program, including litter control
- Water fowl control program
- Catch basin labeling program
- Improved enforcement of "pooper scooper" laws
- Review and strengthen stormwater regulations

In order to achieve solids reductions of 30% to meet the BMP plan goal, further improvements to three of the more critical source control measures beyond year 2000 practices will be necessary. These best management practices are catch basin cleaning, construction site controls, and street sweeping.

The BMP goal is to achieve a 30% reduced solids loading of 750 cubic yards per year between 2000 and 2006. While several source control programs are underway and others have been recommended in the DEIR to reduce sediment loadings from runoff, only a limited number will be counted towards meeting the solids reduction goal. The following source control recommendations seek to reduce source control loadings, recognizing that treatment control measure will also be required to fully achieve the 30% reduction goal.

5.4.1.1 Catchbasin Cleaning

Table 5-5 shows the recommended catch basin cleaning program, and annual sediment reductions estimated from the enhanced practices. The table shows the change from Year 2000 to Year 2006 practices for BWSC, MHD, and MDC controlled catch basins. As shown in the table, the increased catch basin cleaning is estimated to reduce sediment loadings by 72 cu yd per year, almost 10% of the 750 cu yd reduction goal.

The reductions are based on assumptions regarding annual catch basin accumulation rates, and the proportion of sediment that is retained in the catch basin based on how often they are cleaned and the sediment depth in the catch basin sump. Based on preliminary information from the BWSC Citywide Catch Basin Preventive Maintenance project, catch basin accumulation rates vary significantly from basin to basin, but average approximately 10 inches per year. For catch basins with full sumps, all the accumulated sediment will find its way to the storm drainage system and eventually to the receiving waters. For catch basins that are cleaned frequently and have sump capacity, only relatively small portions of the sediment load will be discharged to the storm drains and receiving waters. Sediment captured in the catch

basins was estimated to range from 0 for full sumps with no cleaning to 80% for twice annual cleaning. The reduced sediment load reflects more intensive catch basin cleaning between 2000 and 2006.

Illegally parked cars are major impediments to effective catch basin cleaning practices. In order for catch basin cleaning programs to be as effective as possible, strict enforcement of no-parking regulations will be necessary.

Table 5-5
Recommended Catch Basin Cleaning Practices

Owner	***No. of Catch Basins***	***2000 Practice***	***2006 Practice***	***Estimated Annual Sediment Reduction***
Boston	161	Varies by location, but typically once every three years	Once every two to three years[1]	20 cu yd
Brookline	2120	Varies by location, but typically once or twice a year	No change from 2000	No expected reduction
MDC	90 (est.)	Varies by location, goal of once per year	Once per year all locations	40 cu yd
MHD	83 (est.)	Once every two years	Once per year	12 cu yd
Newton	224	Varies by location, but typically once or twice a year	No change from 2000	No expected reduction
Total	**2722**		**72 cu yd 9.6% of 750 cu yd reduction**	

[1] The DEIR detailed BWSC's Catch Basin Identification, Inspection, and Cleaning program. This program continues. Phase III of the program is developing a catch basin preventive maintenance plan. The plan measures catch basin sediment accumulation rates and considers factors such as land use, slope, and street sweeping. The purpose of the program is to scientifically evaluate appropriate catch basin cleaning rates. Therefore, the catch basin cleaning frequency contained herein may be modified based on the results of that program.

5.4.1.2 Street Sweeping

Recommended street sweeping practices for year 2006 are presented in Table 5-6. The Year 2000 street sweeping practices are estimated to control over 2000 cubic yards. The enhanced 2006 street sweeping practices represent a relatively small reduction in loadings, because current practices are generally good and will continue in the majority of the watershed (Brookline and Newton, representing about 75% of the total watershed area). The expected reduction in TSS load represents a relatively modest improvement in a relatively small portion of the watershed (the 25% of the watershed area in Boston) for a management practice that can at most reduce loading by 10 percent. Enhanced street sweeping practices will result in a small but perceptible reduction in annual Muddy River loadings.

Illegally parked cars are major impediments to effective street sweeping practices. In order for street sweeping to be as effective as possible, strict enforcement of no-parking regulations, including ticketing and towing, will be necessary.

Street sweeping is currently effective at removing sediment, and needs to continue and should be improved. However, as shown in the table below, the effect of improved street sweeping practices will have a relatively small impact on meeting the sediment reduction goals of the BMP program.

Table 5-6

Recommended Street Sweeping Practices

Owner	*2000 Practice*	*2006 Practice*	*Sediment Reduction*
Boston	Commercial areas once a week, Remaining areas once a month, April 1 – November 30	Once a week, commercial areas twice per week	5 cu yd
Brookline	Once a week, commercial areas every night.	No change from 2000	No expected reduction
MDC	Varies by street based on need	Once a week	5 cu yd
MHD	Annually in the Spring	No change from 2000	No expected reduction
Newton	Once a week	No change from 2000	No expected reduction
Total		**10 cu yd 1.3% of 750 cu yd reduction**	

5.4.1.3 Construction site and new development controls

The Draft EIR estimated that construction sites contributed 10% of annual solids loadings in 2000 or approximately 250 cubic yards per year. Between 2000 and 2006, the following construction site BMPs are being instituted:

- *EPA's Phase II Stormwater Management Program.* This program requires construction site operators to prepare a stormwater management plan including erosion and sediment control measures for all construction sites disturbing more than one acre. Under Phase I of the program, effective prior to 2000, only sites disturbing more than 5 acres were required to develop stormwater management plans. Since the Muddy River is located in a highly developed urban landscape, reduction of the threshold will dramatically increase the amount of construction area subject to the regulations, with a resultant decrease in solids loadings from construction sites.

- *BWSC's controls on development and re-development.* BWSC regulations require all new or re-developed sites to retain stormwater on site and to construct and maintain structural BMPs (typically particle separators) on all parking lots exceeding 7,500 square feet. Similar requirements are being proposed in a warrant article to go before Brookline Town Meeting in May 2003. Considering the fact that most land in the Muddy River watershed is privately owned, these steps provide

the communities with the means to reduce solids loadings from privately owned lands not directly under the jurisdiction of the communities.

Year 2000 construction solids loads are estimated to be 250 cubic yards per year. With these strict new controls in place, the solids loading from construction sites is conservatively estimated to decrease to 125 cu yd per year, or 17% of the 750 cubic yard goal.

5.4.1.4 Other

As discussed in Section 5.7 of the Draft EIR, another important source control BMP is the correction of situations in which roadway drainage from the MDC parkways overflows the curb and erodes the slope in the parklands, resulting in sediment loading to the river. There are several causes for this erosion, including undersized and/or clogged drainage systems, poor soils and/or cracked and leaking pipes, leading to irregular settling of pavement and curbing. Necessary repairs include correcting unsuitable foundation problems and repair and/or replacement of catch basins and storm drains with subsequent pavement repairs. Each location will be examined to determine the level of necessary repair. Design of repairs will take place in early 2003, with construction of repairs slated to be part of the capital project.

Park, turf and trail maintenance is another source control BMP necessary to reduce erosion from pathways, therefore minimizing the sediment entering the river. Park and trail maintenance is discussed further in Section 6.

5.4.2 Stony Brook Conduit

The Stony Brook Conduit is currently undergoing dramatic changes that improve flood conditions and improve the water quality of the Muddy River. The improvements in the Stony Brook Conduit are considered a BMP since there would be a change in operations, structural changes through separation, and improvement maintenance. All of these measures result in improved quality of stormwater discharges from the Stony Brook Conduit.

The improvements in the Stony Brook Conduit include:

- *BGH#1 renovations and operations designed to minimize flow from the SBC to the Muddy River.* Typically, the BGH#1 will completely isolate flow between the Muddy River and the Stony Brook Conduit. Rarely, perhaps twice a year, during very large storms, there is some flow from the SBC to the Muddy River for flood control purposes. However, the vast majority of flow will be isolated from the Muddy River. The small portion of flow that discharges will have significantly reduced sediment loads because of the cleaning, separation, and illicit connection removal programs. This source of sediment to the Muddy River, estimated at 256 cu yd per year for the year 2000, will be virtually eliminated in 2006 conditions. This is 34% of the total 750 cubic yards reduction necessary to achieve the goal of 30% reduction in solids loading.

- *Sewer separation.* The Boston Water and Sewer Commission has undertaken a $35.2 million project to separate the combined portion of the Stony Brook Sewer System tributary to the SBC, an area of 575 acres, to improve water quality in the Muddy and Charles Rivers. When completed in 2006, the SBC will convey only dry weather brook flow and stormwater. Eliminating combined sewage from the Stony Brook Conduit significantly reduces the sediment load in the Conduit.

- *SBC Cleaning.* The cleaning of the SBC was completed at a cost of $5.5 million in spring 2002. This improvement restores the capacity of the Stony Brook system and significantly reduces flooding.

- *Removal of Illegal Connections in the separated portion of the system.* Since January 1999, a consultant to the Commission has been conducting a program to identify illegal sanitary connections to storm drains in the separated area served by the SBC. To date, 300 illegal discharges have been identified, 256 of which have been removed. The Commission is currently in the process of removing the remaining illegal connections. All illegal connections are expected to be eliminated, thereby dramatically improving stormwater quality in the SBC. The total cost of the program, including the cost to correct the illegal connections, is estimated to be $1.6 million.

5.4.3 Recommended Structural BMP Plan

5.4.3.1 Center for Watershed Protection Sites and Suggested Modifications

The Center for Watershed Protection (CWP) included 19 potential sites for structural BMPs in the Village Brook subwatershed in the Lower Charles River Basin Retrofit Inventory (July 1999). These sites and the recommended BMPs represent an initial look at a structural BMP program for a portion of the Muddy River watershed. The CWP program does not represent a complete program of structural BMPs to meet a specific goal of water quality but was first step in identifying technologies to improve water quality.

Sites previously identified by the CWP were revisited in October 2002. Each site was evaluated for feasibility based on the following criteria: accessibility, available space, land use, land ownership, and utilities. Of the 19 sites evaluated by the Center in 1999, 14 were included as potential sites in the structural BMP plan. The screening program for the plan is discussed in Section 5.4.4. Three sites included in the CWP's inventory utilized sediment traps, or forebays. These BMPs were eliminated from consideration in the structural BMP plan due to their low efficiency rating in removing solids (estimated to be approximately 25%). Though forebays are a good "last resort" for capturing sediment before it gets carried down the river, the focus of this structural BMP plan is on treatment control measures further up in the watershed.

A fourth site - a perimeter sand filter sited for an area adjacent to the MBTA Green Line – was further evaluated and not found to be feasible. Since the time of the 1999

CWP survey, a new handicap platform was constructed on this site. The fifth site identified by the CWP but eliminated from the structural BMP plan was a wet pocket pond. This site was determined not to be feasible based on conflicts with existing utilities (large aqueduct) as well as the controversy with standing water for health and safety reasons.

5.4.3.2 Evaluation of Additional Sites

As discussed in Sections 5.4.1 and 5.4.2, improvements to source control BMPs are estimated to account for approximately 62% of the needed 750 cubic yard reduction in sediment to meet the overall goal of 30% reduction in solids to the Muddy River. This in turn, requires that structural BMPs must be designed to account for 38% (285 cubic yards) of the needed 750 cubic yards annual reduction.

In order to achieve this goal, additional sites beyond what the CWP identified in its 1999 study were evaluated. The recommended structural BMP plan is comprised of four main components:

- Sites evaluated based on CWP initial identification
- Additional sites identified in October 2002
- Particle separators located in public ways
- Regulations requiring structural BMPs on new and re-developed privately owned land

Methodology

A field evaluation of approximately 60 sites, including the CWP sites was conducted in September and October 2002. Potential sites were identified using GIS data obtained from the City of Boston and the Town of Brookline. Using the GIS, publicly owned open space was identified. Sites identified in the GIS were field checked for similar criteria as discussed in Section 5.4.3, such as accessibility, available space, cost, land ownership, land use, and utilities.

Following the field evaluation, a list of 34 sites was compiled, including sites previously identified by the CWP and new sites identified through GIS and field evaluations in other portions of the watershed. Of these 34 sites, 24 are sited on public land (i.e. open space, traffic islands, and parking lots) while 10 are sited on private land (primarily large parking lots). The drainage area for these 34 sites ranges from 0.3 to 145 acres, with a total of 505 acres treated if BMPs on all 34 sites were implemented.

The distribution of potential BMP sites throughout the watershed is shown in Figure 5-2. The 34 sites were further reviewed by municipal officials for compatibility with current land use and integration with current operations. Five sites were selected for further evaluation of structural BMPs, other than particle separators, as summarized in Table 5-7.

With these structural BMPs in place, an estimated 10 additional cubic yards of sediment will be removed from the watershed on an annual basis.

Table 5-7

Summary of Potential BMP Sites

Municipality	*Site*	*Subwatershed*	*Drainage Area*	*BMP Type*
Brookline	Boylston Street Playground	VB-4	2	Underground Sand Filter
Brookline	Dudley Triangle	VB-11	8	Dry Swale
Brookline	Harry Downes Field	CS-1	5	Underground Sand Filter
Brookline	Health School Parking Lot	VB-13	2	Bioretention
Boston	Victory Gardens	BBF-1	4	Swale

5.4.3.3 Types of BMPs evaluated

Five types of structural BMPs were evaluated, including the following:

- Bioretention
- Dry Swales
- Perimeter sand filters
- Underground sand filters
- Particle separators

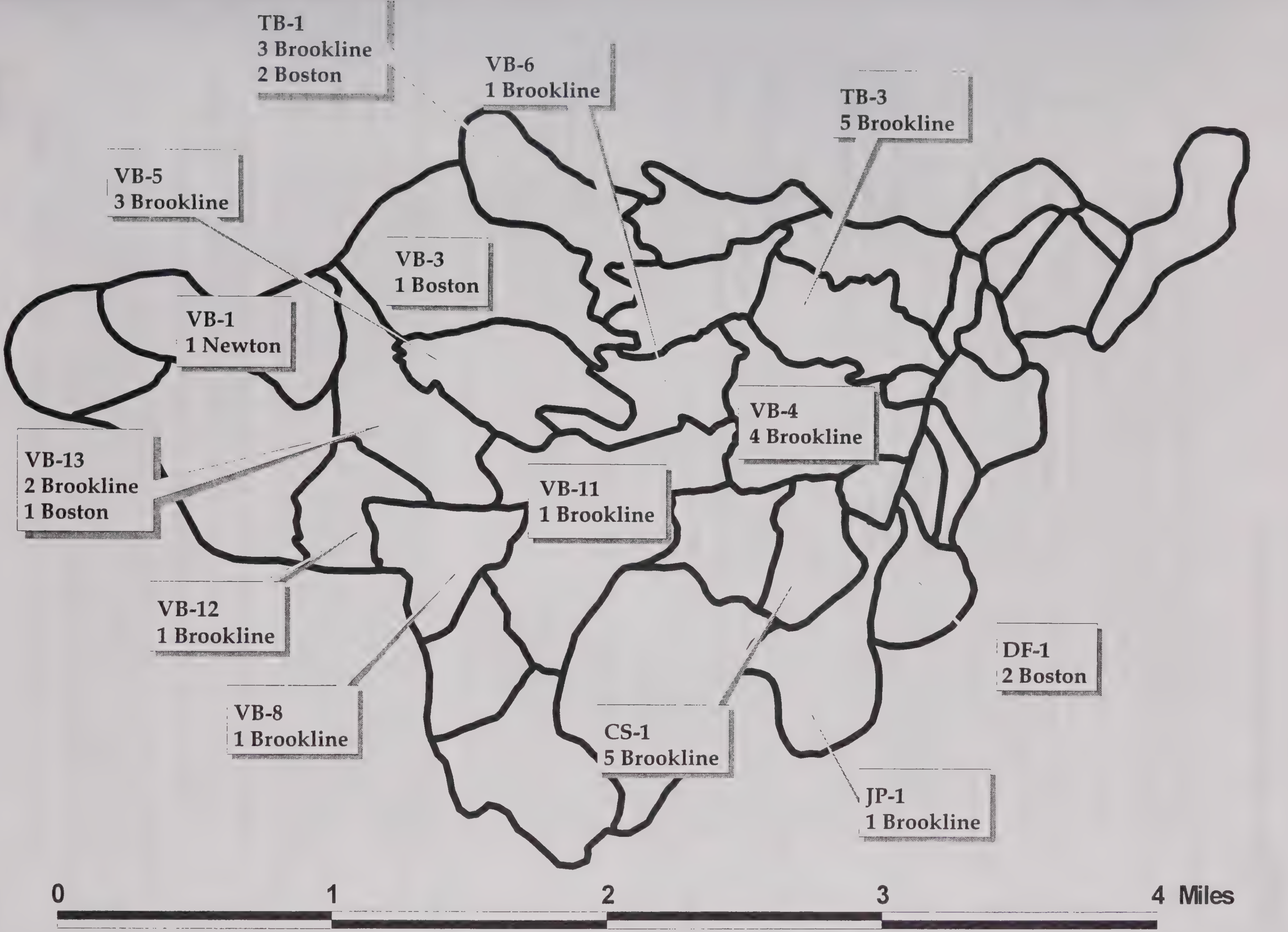

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Figure 5-2. Location of Proposed BMPs in Watershed

Bioretention areas or biofilters are useful in treating small drainage areas and are particularly useful as retrofits in existing parking lots. Bioretention areas are landscaping features adapted to provide onsite treatment of stormwater. Surface runoff is directed into shallow, landscaped depressions. These depressions are designed to incorporate many of the pollutant removal mechanisms that operate in forested ecosystems. During storms, the design volume of runoff is collected above the filter, and then percolates through the mulch and prepared soil mix. Stormwater exceeding the design volume bypasses the filter. Typically, the filtered runoff is collected in a perforated underdrain and returned to the storm drain system.

Biofilters have few constraints and can be applied to most development and re-development sites, including highly urbanized areas. They are commonly located in parking islands or within small pockets of residential land uses. Biofilters can be an aesthetic benefit if well-designed, but they require frequent maintenance to maintain plant health and prevent clogging of the soil pores and the underdrain.

Dry Swales are a series of vegetated, open channels designed specifically to treat and attenuate stormwater for a specified water quality volume. As stormwater flows through these channels, it is treated through filtering by the vegetation in the channel, filtering through a subsoil matrix and/or infiltration into the underlying soils. In addition, the velocity of the stormwater is reduced before it is discharged, allowing the sediment to settle.

Swales require significant land area and may not be feasible in some urban areas. However, swales are very effective for treating road and highway runoff because they are linear structures. Swales can be less expensive than curb-and-gutter systems but may require more maintenance. Although swales can accentuate the natural landscape, they should be gradually sloped and well-vegetated to avoid the appearance of a ditch.

Sand filters generally use a settling chamber (to remove coarse particles) followed by a filter bed filled with sand or another filtering media. The finer particles and other pollutants are removed as stormwater flows through the filtering media. Sand filters can be widely applied and are good options in urbanized areas because they consume little space. However, they do have the potential for clogging and require frequent maintenance. Surface sand filters can also be unattractive unless they are landscaped.

Variations of sand filters evaluated for use in the Muddy River watershed include perimeter sand filters and underground sand filters. Perimeter sand filters are useful in urbanized areas with little usable space such as parking lots or traffic medians.

Underground sand filters are slight design variations of the typical surface sand filter and are located in an underground vault. Underground sand filters are designed for high-density land use or ultra-urban applications where there is not enough open space for a surface sand filter or other structural BMP. Underground sand filters can be sited for areas such as parks and playgrounds, with accessible publicly owned

open space. Once installed, underground sand filters are inconspicuous, though in order to extend their useful life they cannot be placed in high traffic areas. Underground sand filters require a high level of maintenance and should only be used when adequate maintenance can be guaranteed.

The underground sand filter is a three-chamber system. The initial chamber is a sedimentation (pretreatment) chamber that temporarily stores runoff and utilizes a wet pool to capture sediment. The sedimentation chamber is connected to the sand filter chamber by a submerged wall that protects the filter bed from oil and trash. The filter bed is 18 to 24 inches deep and may have a protective screen of gravel or permeable geotextile to limit clogging. The sand filter chamber also includes an underdrain system with inspection and clean out wells. Perforated drain pipes under the sand filter bed extend into a third chamber that collects filtered runoff. Flows beyond the filter capacity are diverted through an overflow weir. (www.georgiastormwater.com)

Particle separators, or swirl separators, use fluid dynamics within a pre-designed unit to separate liquid stormwater with solid contaminants, including suspended sediment, floating debris, oil and grease, and vegetative materials. A number of proprietary products exist, including Bay Saver, CDS (continuous deflective separation) Units, Downstream Defender, Stormceptor, Vortechnics, HydraSep, and Aqua-Swirl. Particle separator units are sized by the drainage area they control, and are designed to take the first flush from storms. The units are maintained by vacuum or clamshell removal of solids, similar to catch basins, and require cleaning, on average, twice annually.

Figures 5-3 through 5-5 are conceptual designs of the structural BMPs described above.

5.4.3.4 Additional particle separators

Additional particle separators were evaluated for use in the Muddy River watershed to control the remainder of the solids loading necessary to achieve the 30% overall solids reduction. Including the recommended improvements to source control measures and the structural BMP plan discussed in the previous section, approximately 33 additional particle separators will be necessary. In order to meet the 30% goal, these particle separators will be required to treat an approximate drainage area of 490 acres, for an estimated reduction in solids loading of 280 cubic yards per year. It will be necessary to construct particle separators throughout the watershed in both Boston and Brookline.

Results of the pilot program on particle separators will be used to ensure proper design and siting of any additional particle separators in the watershed. Additional particle separators are an important part of the structural BMP plan, due to the lack of available space in the watershed for the other types of structural BMPs discussed in the previous section. The benefit of particle separators is the capability to place them in streets that are already in the public right of way.

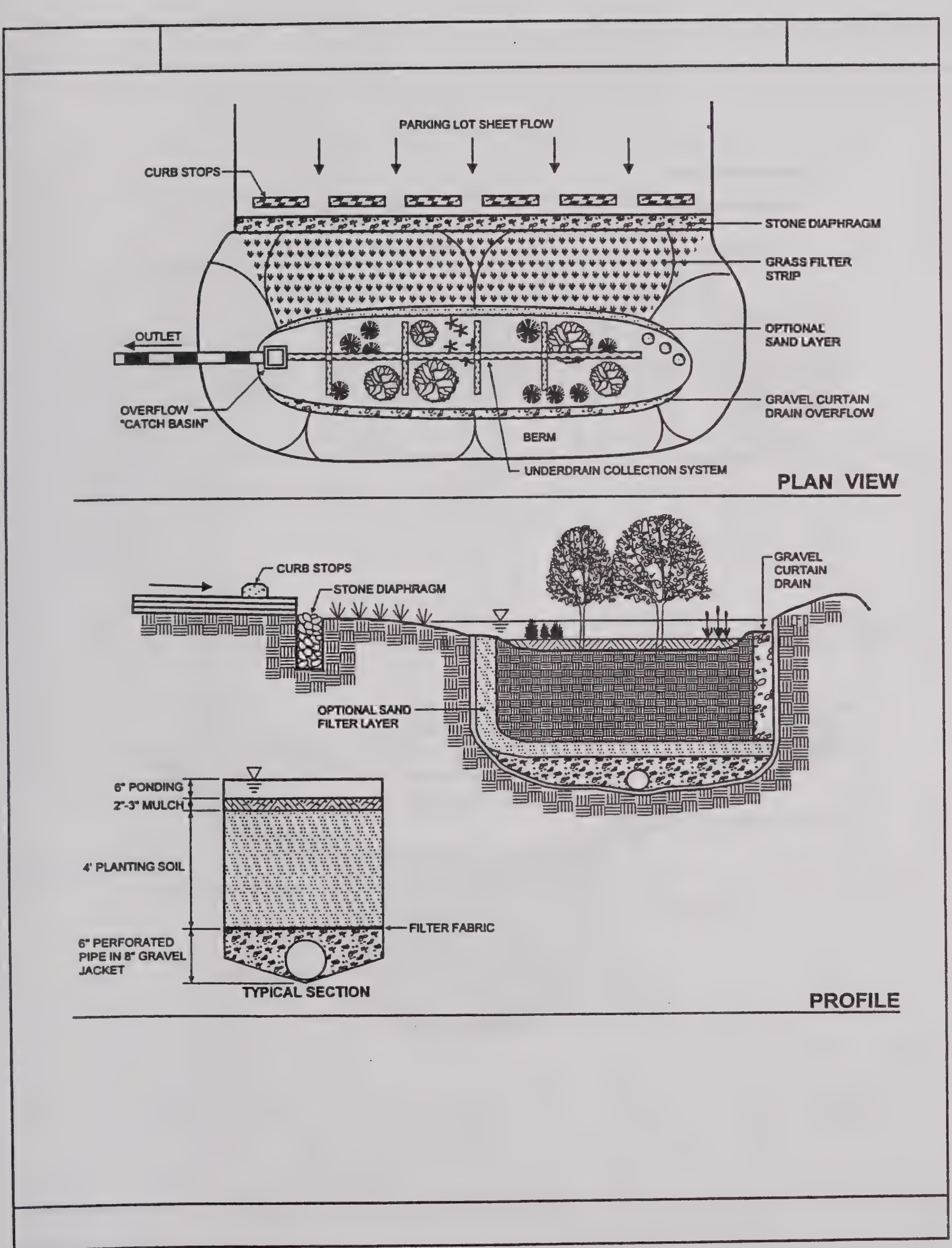

Figure 5-3: Conceptual design of bioretention (CWP, 1999)

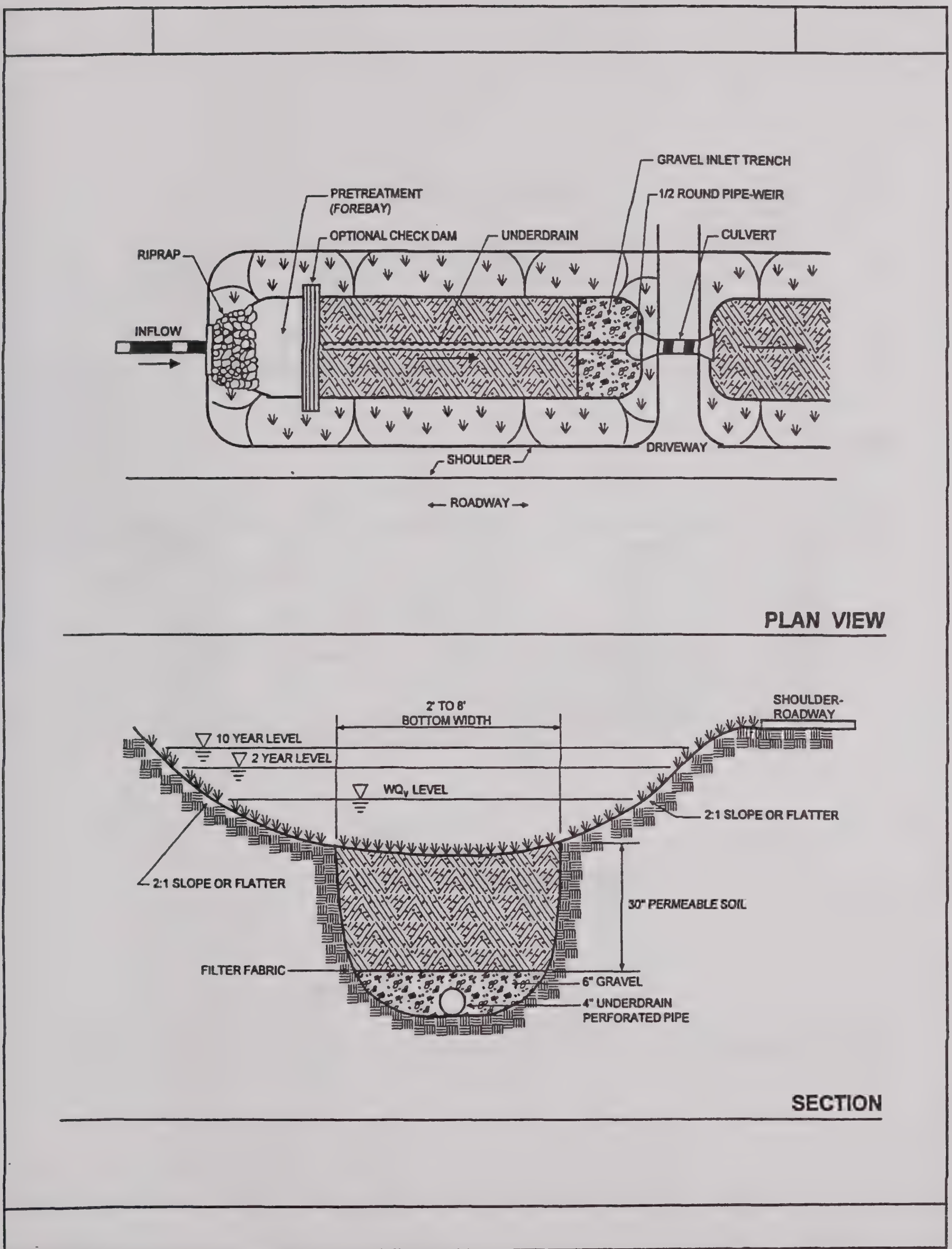

Figure 5-4: Conceptual design of a dry swale (CWP, 1999)

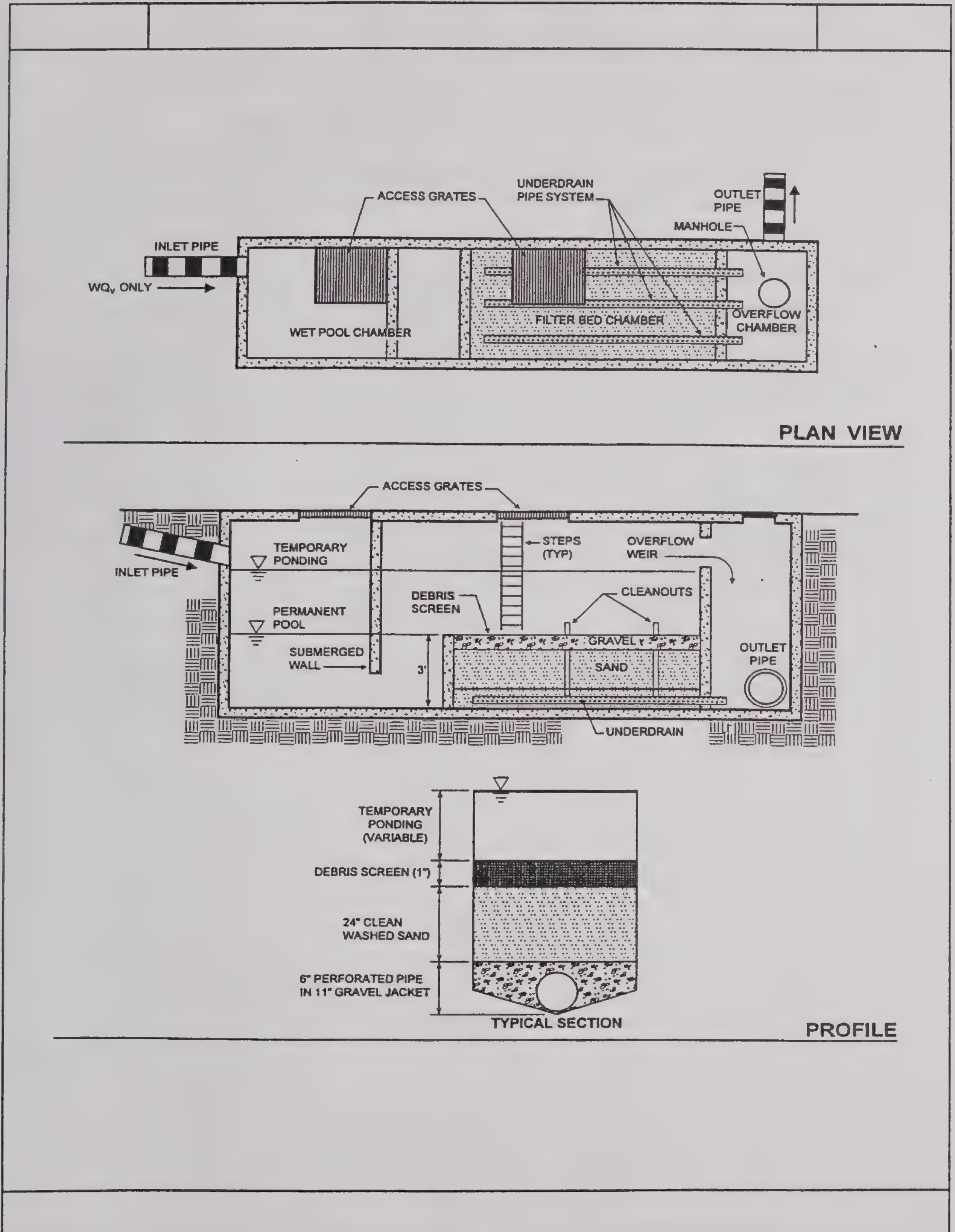

Figure 5-5: Conceptual design of an underground sand filter (CWP, 1999)

Of the 33 particle separators required to meet the solids reduction target, sites for 10 of these units have been evaluated on a preliminary basis. The proposed sites are examples of the locations for which particle separators could be sited, and are summarized in Table 5-8. Sites for the remaining particle separators will be selected as the units are designed. Additional sites for particle separators could include areas where the storm drain system is modified to prevent flow over curbs on MDC roadways. During design of drainage system improvements to correct curb settings and pavement settling, consideration should be given to installing a particle separator as part of the construction.

Other locations recommended for installation of particle separators, in addition to the 33 proposed for the project, include the Charlesgate area. Water quality samples taken by field staff during dredging in Fall 2002 indicated high levels of total suspended solids coming from drainage from the Massachusetts Turnpike. The Massachusetts Turnpike Authority should consider installing a particle separator to treat this drainage before it enters the Muddy River at Charlesgate.

During the preliminary design of each unit if the field conditions (access, utilities, land ownership, easements, etc.) make any one site too difficult to develop, an additional alternate site will be substituted. The ultimate goal will be to control 490 acres. Particle separators will be designed to treat flows from the 2-month storm. Depending on the imperviousness of the drainage area, particle separator units will treat areas ranging in size from 10-20 acres.

A map showing the location of the 10 example sites for particle separators, as well as the recommended sites for the other five structural BMPs is shown in Figure 5-6.

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Figure 5-6: Location of Potential Sites for Structural BMPs

Table 5-8

Proposed sites for Particle Separators.

Municipality	*Subwatershed*	*Drainage Area, Acres*	*Approximate Location*	*Approximate Unit Size (L x W, ft)*
Boston	DF-1[1]	14.5	Jamaicaway at Bynner Street	18 x 12
Boston	HU-1	14.4	Calumet Street near Tremont Street	18 x 12
Boston	RV-1 and RV-2	19.8	Pilgrim Road at Brookline Avenue	18 x 12
Boston	VB-3	10.6	Colbourne Road at Ransom Road	18 x 12
Brookline	TB-1	20.3	Driscoll School Lot, Beacon and Washington Street	16 x 10
Brookline	LW-1	15.8	Lawrence School, parking lot at end of Newell Road	18 x12
Brookline	TB-3	20.2	Harvard Street at Auburn Street	18 x 12
Brookline	VB-6	17.6	Tappan Street at Blake Road	15 x 9
Brookline	VB-3	18.9	Salisbury Road at Windsor Road	16 x 10
Brookline	SP-1 and CS-2	32.0	Sergeant Road south of Codman Road	18 x 12

1) The particle separator recommended for construction in the Daisy Field subwatershed is in addition to other improvements for the Daisy Field area.. Temporary measures, such as hay bales and a silt fence have been installed to control runoff. The infield will be reconfigured and moved away from Leverett Pond to prevent the direct discharge of runoff from the infield into the pond.

5.4.3.5 Additional reduction from BMPS on private re-development

Additional reduction in solids loading to the Muddy River will be achieved by recent efforts by BWSC and the Town of Brookline in enforcing private re-development to control stormwater runoff onsite.

Since 2000, new BWSC regulations require new or re-developed sites to retain stormwater on site. In addition, BWSC requires developers to construct and maintain BMPs if the site has more than 7500 square feet of parking. According to BWSC, often the onsite BMP selected by private developers is a particle separator.

The Town of Brookline is currently evaluating a similar requirement, which is scheduled to be a warrant article for May 2003 Town Meeting.

Although it is difficult to estimate the impact of these requirements, these actions will have owners of private land controlling the sediment loadings from their land, thereby reducing loads to the Muddy River. A current example of a BMP on privately re-developed land involves the recent development at Emmanuel College, construction of which included a particle separator.

Boston and Brookline should institute a tracking system for determining the locations of new privately owned BMPs, and the sediment removal reductions attributable to their construction. They should also make sure there is a mechanism in place for privately owned BMP maintenance. As private re-development BMPs are implemented, an equivalent number of publicly owned particle separators will not have to be implemented.

5.5 Summary of BMP Program

5.5.1 Summary of BMPs

This section summarizes the BMP program as discussed in the Draft EIR. Both the non-structural and structural BMP measures described thus far in this section are recommended as additions and enhancements to the BMP program discussed in the Draft EIR. The Draft EIR outlined a comprehensive BMP program for the watershed, including both source and treatment control BMPs.

Basin-wide source control measures included in Draft EIR include:

- Annual water quality sampling program
- Improved street sweeping program
- Institute catch basin cleaning/tracking
- Trail maintenance
- Public education program, including litter control
- Water fowl control program
- Catch basin labeling program
- Improved enforcement of "pooper scooper" laws

- Review and strengthen stormwater regulations

In addition to the basin wide source control measures, additional source control measures were listed for each area of the park (i.e. Back Bay Fens, Riverway, Leverett Pond, Willow Pond and Ward Pond). Examples of the source control BMPs specified for each of these areas are:

- Public education program for pesticide/herbicide/fertilizer use (Back Bay Fens)
- Correction of "desire lines" with re-vegetation (Back Bay Fens, Riverway, Willow Pond)
- Repair drainage system and curbs along roadways (Back Bay Fens, Riverway)
- Treatment control BMPs were recommended in the Draft EIR, though exact locations and sizing were not specified. The treatment control BMPs included particle separators, sedimentation basins, and a swale. In lieu of the sites for particle separators listed in the Draft EIR, an enhanced particle separator program as discussed in Section 5.4.3.4 has been developed. A summary of some example locations for particle separators, to replace those listed in the Draft EIR, is included in Table 5-8.

Sedimentation basins were proposed in the river in the Back Bay Fens, Riverway, Leverett Pond, and Willow Pond. The sedimentation basins are further discussed in Sections 3 and 4. A vegetated swale was proposed for the Victory Gardens in the Back Bay Fens. In addition to the swale at the Victory Garden included in the Draft EIR, a second swale, a bioretention area, two sand filters and various particle separators are proposed as described in previous sections.

5.5.2 Summary of the Impact of BMPs

The Draft EIR outlined a comprehensive BMP program for the watershed, including both source and treatment control BMPs, as summarized in the previous section. The Secretary's Certificate on the Draft EIR called for a more specific program, particularly in regards to structural BMPs. The goal of this additional work was to re-evaluate the watershed on a more detailed basis, and provide specific sites for structural BMPs, including particle separators.

As mentioned in the beginning of this section, the goal of the BMP program is to reduce the solids loading to the Muddy River by 30%, or from an estimated 2500 cubic yards per year in 2000 to 1750 cubic yards per year in 2006. Improved source control measures contributing to the 30% reduction include the following:

- Street sweeping – expected reduction 10 cubic yards (1.3%)
- Catch basin cleaning – expected reduction 72 cubic yards (9.6%)
- Construction site controls – 125 cubic yards (17%)

- Stony Brook conduit – cleaning and improvements – 256 cubic yards (34%)

The total estimated reduction from source control BMPs and cleaning and improvements to the Stony Brook Conduit is approximately 460 cubic yards per year, or 62% of the total 750 cubic yard reduction.

Structural BMPs, including particle separators, are necessary for the additional reduction of 290 cubic yards of sediment, for a total annual reduction in solids loading of 750 cubic yards per year. The majority of the structural BMPs will be comprised of particle separators, as discussed previously in Section 5.4.3.4. Five additional sites are proposed for implementation of other structural BMPs, such as sand filters, swales and a bioretention area.

Figure 5-7 shows the breakdown in expected reduction in solids from non-structural versus structural BMPs.

5.6 Cost Estimates

The estimated cost of each individual BMP is necessary in calculating on overall cost for the BMP program for the entire watershed. Probable construction costs for structural BMPs are included below, followed by a summary of all capital BMP costs from the Draft EIR plus the new structural BMP costs. Maintenance costs are included in Section 6.

The estimated cost for each BMP is listed in Table 5-9. Costs include initial capital costs for construction, including equipment, contingencies and engineering, but do not include any cost for land taking or other site-specific costs. For particle separators, an allowance for moving two utilities at each site has also been included but this is not based on site-specific information. The allowance for utility relocation was based on cost data for existing particle separators constructed by the Town of Brookline.

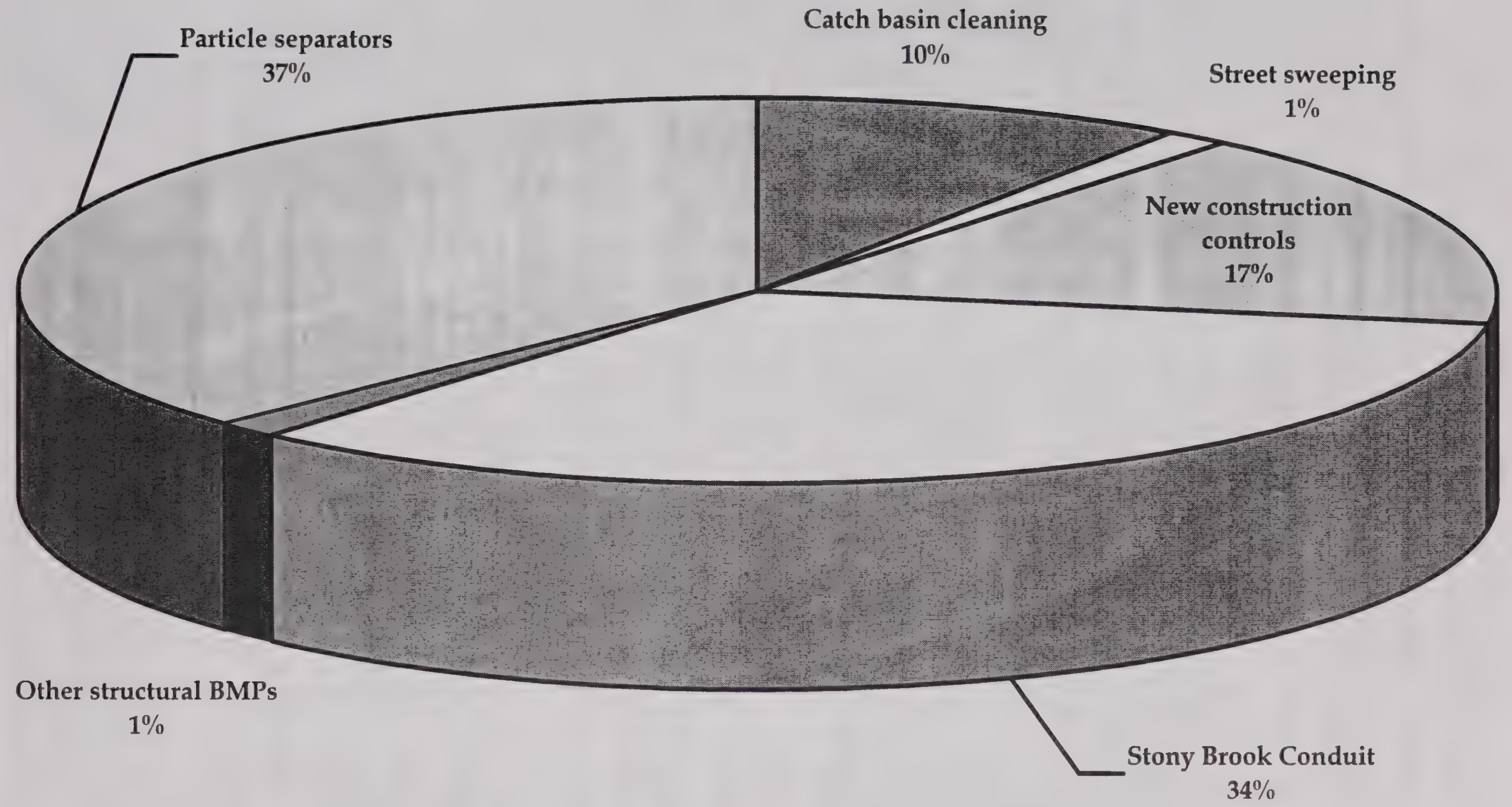

Figure 5-7: Reduction in Solids Loading from BMP Program

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Table 5-9

Location, Drainage Area, and Estimated Costs of Structural BMPs.

BMP Type	*Municipality*	*Location*	*Drainage area treated, acres*	*Cost*[1]
Bioretention	Brookline	Health School Parking Lot	2	$19,000
Dry Swale	Brookline	Dudley Triangle	8	$53,000
Underground Sand Filter	Brookline	Harry Downes Field	5	$72,000
Underground Sand Filter	Brookline	Boylston Street Playground	2	$28,000
Dry Swale	Boston	Victory Gardens		$112,000
Particle Separator	Boston	Jamaicaway at Bynner Street	14.5	$124,200
Particle Separator	Boston	Calument Street near Tremont Street	14.4	$124,200
Particle Separator	Boston	Pilgrim Road at Brookline Avenue	19.8	$124,200
Particle Separator	Boston	Colbourne Road at Ransom Road	10.6	$124,200
Particle Separator	Brookline	Driscoll School Lot, Beacon and Washington Street	20.3	$81,000
Particle Separator	Brookline	Lawrence School parking lot, at end of Lawrence Road	15.8	$124,200
Particle Separator	Brookline	Harvard Street at Auburn Street	20.2	$124,200
Particle Separator	Brookline	Tappan Street at Blake Road	17.6	$74,300
Particle Separator	Brookline	Salisbury Road at Windsor Road	18.9	$81,000
Particle Separator	Brookline	Sargent Road south of Codman Road (private way)[2]	32.0	$124,200
23 Additional Particle Separators	Boston and Brookline	Various	Average 15-20 acres	$2,857,000
Totals Structural BMPs				$4,246,700

1) Unit costs for particle separators from vendor. Costs for other structural BMPs derived from the Center for Watershed Protection. *Costs and Benefits of Stormwater BMPs* (1998) and escalated to represent 2003 dollars and rounded to the nearest thousand dollars.

2) Potential location for proposed particle separator is located in private way. If agreement cannot be worked out with property owner, an alternate site within the Chestnut Street drainage area will be sited.

The total capital cost of the structural BMP program is $4,246,700. Approximately $1,389,700 of the program consists of identified swales, sand filters, a bioretention area and 10 particle separators. The remainder of the program includes another 23 particle separators to address runoff from about 400 acres.

The structural BMP program in the Draft EIR included $4,487,000 in costs for an undefined group of structural BMPs, a swale at the Victory Gardens, and four additional particle separators. The structural BMP program in this section will replace that included in the Draft EIR. The in-stream sedimentation basins, and curb and drainage system improvements on MDC and Brookline roadways would remain the same.

The structural BMP program proposed as part of the initial capital program as part of the Phase I Muddy River Project in this Final EIR would include the defined structural BMPs including the swales, bioretention area, sand filters, and 10 particle separators from Table 5-9. The cost of these defined BMPs would be $1,389,700. An additional $2,857,000 of the undefined particle separators would be included in the initial capital program.

The total structural BMP program in the Final EIR is approximately $240,000 less than that provided in the Draft EIR. The program has been significantly refined and is more specific than that in the Draft EIR, based on actual field visits to the site within the watershed. We have chosen not to update the entire project cost from the Draft EIR at this point since the slight reduction in structural BMP costs would be offset by the increase in disposal at Charlesgate so the overall cost would essentially be the same.

The locations of the 23 undefined particle separators would be selected during design to take into account drainage area, available space and utility location to control costs of these additional separators. Furthermore, in areas where drainage system reconstruction is required to correct curb settings and pavement settling, consideration will be given to constructing particle separators as part of the modified drainage system. The particle separator recommended for consideration to control drainage from the Massachusetts Turnpike near Charlesgate (discussed in Section 5.4.3.4) would not, however, be included in the project costs.

5.7 Maintenance Plan

An important component to the recommended plan is a maintenance plan. Structural BMPs must be properly maintained to ensure effective sediment removal rates. The frequency with which different types of structural BMPs must be maintained varies greatly, depending on the watershed and loading. This is one of the major reasons that data from the pilot program is so important prior to siting and designing any

additional particle separators in the watershed. Likewise, several BMPs such as sand filters sited for design in key locations in the watershed, should be installed and monitored prior to implementing other similar structural BMPs in other locations in the watershed. This is to ensure that specific types of BMPs are effective and that the entities are able to maintain the BMPs to the maximum extent possible to ensure sediment removal efficiencies.

Source control measures must also be properly maintained, both in terms of actual equipment maintenance as well as continuing with the program and not reducing frequency of certain practices such as catch basin cleaning or street sweeping when staffing is low or budget cuts are required.

Ongoing maintenance of both source and treatment control BMPs will be included in the Annual Update to the Secretary, as described in the Draft EIR. Maintenance activities are described further in Section 6.

6

Section Six

Section 6
Management Structure and Maintenance Plan

6.1 Introduction

This section proposes an appropriate maintenance program and management structure for the Phase I Muddy River Project. As noted by the Secretary on page 7 of the DEIR certification, such a program and structure will prove critical for protecting the public's investment. The management and maintenance plan for the Muddy River project is compatible and consistent with the requirements of the Secretary of Environmental Affairs in his ENF Certificate, DEIR Certificate and Final Record of Decision (ROD). It also reflects the comments received from the numerous stakeholders and interested citizens on the DEIR (including the Emerald Necklace Citizens Advisory Committee) and Draft ROD. The management structure will ensure coordination and cooperation between project proponents as well as ensure a coordinated proponent response to oversight committees, agencies and the public.

The Muddy River Project area defined in Section 1 includes the Muddy River from the Charles River to Wards Pond; the bordering wetland and riparian areas rehabilitated for the project; and adjacent park areas disturbed by construction and restored as part of the project. The management and maintenance plan also includes the contiguous park area to the project area in response to the desire institute a sustaining structure for the park to preserve the investment of public funds in the project area.

The proposed management structure is a Public/Private Partnership between the City of Boston, the Town of Brookline, the Metropolitan District Commission and the Emerald Necklace Conservancy. This partnership is a refined Public / Private Partnership from that described in the DEIR. The proponents reviewed other models both internally and with the Citizens Advisory Committee. Strategic planning meetings of the Emerald Necklace Conservancy's Board of Directors and Stewardship Council addressed the Conservancy's goals for the system as a whole, but also provided valuable insights from a broad range of stake holders about management models for the Muddy River project and contiguous park area. The participants in the partnership will be signatories to a Memorandum of Agreement (MOA) delineating the relationship and responsibilities between the parties and the participants providing public funds will also be signatories to a Memorandum of Understanding (MOU) describing the estimate funding to be provided by the parties. This section presents a brief description of each management structure considered by the proponents, and identifies why a Public/Private Partnership model will be the most effective in providing integrated park management that protects the capital investment expended on the improvements for the Muddy River. The chapter also outlines the role the Public/Private Partnership in relation to public agencies, advisory groups and the oversight committee. There is also a description of the intended MOA and MOU.

The maintenance plan builds on the documentation in the DEIR, consolidating it into a standard form across jurisdictional boundaries and designed for ease-of-use by operations personnel. It was developed with the assistance of a knowledgeable consultant familiar with cooperatively managed historic parks. The operations personnel of Boston Parks, Brookline Public Works and the MDC provided critical assistance in developing a user-friendly format.

6.1.1 Project Area and Goals

The Muddy River project area is a portion of the Emerald Necklace, the core of Boston's and Brookline's historic park system consisting of a series of linear parks of nearly 1,000 acres. The Muddy River project area runs from Wards Pond down through Charlesgate at the Charles River and form the border between Boston and Brookline. The City of Boston, through the Boston Park and Recreation Department, is responsible for maintaining 117 acres of parkland within and adjacent to the project area. The Town of Brookline, through the Parks and Open Space division, is responsible for maintaining 32 acres of parkland within and adjacent to the project area. The MDC owns the Charlesgate section of the Back Bay Fens and is responsible for the care, custody and control of the parkways and parkland located 25 feet in from the curb, an area totaling approximately 35 acres within the project area. The total area at the of the Muddy River Project area and adjacent parklands is 184 acres or 18 percent of the entire Emerald Necklace.

As project proponents, the City of Boston and the Town of Brookline have developed a plan for rehabilitation of the Muddy River consistent with the goals of the Emerald Necklace Master Plan. As described in the Draft EIR, the purpose of the management and maintenance plan is to identify the management, staffing, equipment and procedures that are needed to ensure that the Phase I dredging, daylighting, re-vegetation, general maintenance and establishment of Best Management Practices (BMPs) will be sustained. The goals of the management and maintenance plan are:

- To ensure the success of the five objectives of the Muddy River Restoration Project which are:

  1. Provide flood control;
  2. Improvement of water quality;
  3. Enhancement of the aquatic and riparian habitat;
  4. Historic rehabilitation; and
  5. Implementation of Best Management Practices for stormwater runoff.

- To provide unified, quality based performance standards for maintenance that provide seamless management without jurisdictional barriers.

- To identify specific problems/issues relating to maintenance operations and to develop strategies for dealing with them.

- To explore current and potential resources (personnel, financial, equipment community, institutional) for management and maintenance and to make the best possible use of them.

- To develop a realistic schedule and set of standards for excellent maintenance, addressing the needs and concerns of all parties.

The Town of Brookline (letter to EOEA dated April 4, 2002) and City of Boston (letter to EOEA dated June 25, 2002) have made commitments to include funding provisions for project maintenance in their long range financial planning. These letters are included in Appendix B.

6.2 Management Structure

6.2.1 Introduction

Upon completion of the Phase I Muddy River Project, nearly 100 million dollars will have been spent from federal, state, local and private sources. In order to ensure that this level of investment is protected and preserved, a management structure for the project area and adjacent parks must be in place.

The Muddy River project area is managed by Boston Parks and Recreation Department, Town of Brookline Parks and Open Space Division and the MDC. The Muddy River parks present a unique challenge because they exist in three jurisdictions with separate resources and funding commitments. As noted in 6.1.1, the parks and its waterway form part of the boundary between Boston and Brookline. Despite the physical boundary of the waterway, many voices have expressed a desire for a "seamless" park system. Park users should be able to enjoy the parks without distraction, moving freely and with pleasure from city to town, path to bridge, woodland to overlook, experiencing the very diversity of spaces Olmsted envisioned.

The proponents addressed the vision of "seamlessness" by developing a management and maintenance system that will ensure cooperation and consistency. The management model cannot and should not be perceived as diminishing the role of regulatory bodies or those committees formed in the regulatory process.

6.2.2 Summary of MEPA Decisions Regarding Management Structure

On April 16, 2002, the Secretary of Environmental Affairs issued two decisions on the Draft EIR – a Certificate indicating that the Draft EIR adequately and properly complies with MEPA (see Appendix A), and a Draft Record of Decision (see Appendix B) proposing to grant a Phase One Waiver allowing the Charlesgate element of the project to proceed (pending completion of the Final EIR for the entire project). In each of these decisions, the Secretary comments on the management structure included in the Final EIR.

In the Draft EIR Certificate, the Secretary states that the Final EIR should include selection of a preferred management alternative and the reasons for its selection. The preferred alternative should be compatible and consistent with the other requirements in the Certificate and in the Final Record of Decision allowing the Charlesgate portion to proceed. A chronology of the Draft Record of Decision/Final Record of Decision can be traced in Appendix B.

The issue of management has been a particularly challenging element of the development of the EIR. Some confusion has stemmed from language in the Draft Record of Decision and the Final Record of Decision. The Draft proposed some broad conditions that, as originally described, were not viable. Both the proponents and EOEA staff worked very hard to meet the intent of the conditions – to protect the long-term viability of the project and to prevent segmentation of the project. In several cases, the conditions were refined between the draft and the Final Records of Decision. These refinements are critical in the case of management structure.

While the draft envisioned "implementation of a management structure through the creation of a permanent independent oversight body," the Final Record of Decision clarified the role of this "oversight body" (referred to as a committee) in relation to both existing committees (CAC, TAC) and the proponents. The FROD clearly states that the new committee will:

- participate in the development of performance standards and identify benchmarks to identify progress;
- provide independent review on a periodic basis to evaluate efforts to meet project goals, including long-term management and maintenance goals;
- monitor and evaluate compliance with provisions of federal, state and local permits and approvals (including Section 61 findings); and
- promote close coordination of activities among Boston and Brookline agencies, the MDC and the MBTA.

Further the FROD states "the owners of the resources (Boston, Brookline and the MDC) will of course continue to manage the resources under their control, with the flexibility they need to make day-to-day decisions, and implement long-term management and operational policies."

The clarification that management responsibilities shall remain with the property owners and the change from a permanent body to one that "should extend a sufficient time beyond the completion of improvements described in the FEIR (at a minimum five year)" illustrate two distinct changes from the draft to the Final Record of Decision.

This vision of the new committee is reiterated in the August 21 letter from Jay Wickersham which identifies the formation of the committee "to serve as a forum in which ongoing maintenance and management issues could be publicly discussed, to add an extra level of assurance that the Commonwealth's financial investment in the future of the Muddy River would be protected and that the improvements associated with the Muddy River Project would have the maximum possible design life." The committee is a forum available to the public, eyes and ears for the regulators, but is not described as having management responsibilities. Indeed independent, periodic review of efforts to meet management and maintenance goals is clearly distinct from regular participation in on-going management activities.

The Secretary issued a Final Phase One Record of Decision on July 29, 2002 indicating his satisfaction with the proponents' commitment to establish an independent oversight entity, but noting that comments from the CAC and others show continuing concern over the oversight committee's structure and function. These have been addressed by the proponents in their November 27 letter to the Secretary (see Appendix B).

Betsy Shure Gross, Assistant Secretary at EOEA agreed in conversations with Commissioner Justine Liff and Commissioner Thomas DeMaio that an appropriate name for the new committee was the Environmental Improvements Committee (EIC). The EIC is in effect a hybrid, combining regulatory review of, and citizen participation in, the Muddy River Project. Like regulatory bodies, it stands independent of the project. Like citizen committees, it provides a critical forum for discussion of all project elements. It was with this direction on the new committee's role in the Project that the proponents addressed the issue of management.

6.2.3 Preferred Management Structure

In this section the proponents have chosen to present the preferred alternative first, with the discussion of alternatives in the following subsection. The preferred management structure for the Muddy River Restoration project is a Public/Private Partnership with Boston, Brookline and the MDC as the public entities and ENC serving as the private sector partner. The proposed management structure is designed to ensure that the goals of the Muddy River project are met through cooperative management and appropriate responsibility for long-term maintenance activities.

This structure has been selected because it is consistent with MEPA's direction to protect the public investment in the project and consistent with the proponents' responsibilities for management of municipally owned resources. The agencies responsible for park maintenance want to provide a seamless approach to maintenance not only within the Muddy River Parks but through the city's and town's parks as a whole. Retaining authority over the park areas in any management structure allows this to happen. However, in order to protect the massive public investment in this project, the city, town, and state have agreed to work cooperatively and to integrate a private entity dedicated to protecting Olmsted's Emerald Necklace parks into on-going management.

In the Public/Private partnership a senior representative of each entity (Boston, Brookline and MDC) with parkland responsibilities would meet with the private entity (ENC) and set policy and goals for work inside the project area, parkland (park maintenance) and for work outside the parkland (principally BMPs). These representatives would be Commissioner/Director level at each agency and have the ability to commit resources or influence the commitment of resources to the management and maintenance effort. Consistent with the Final Record of Decision, Boston, Brookline, and MDC will continue to manage the resources under their control, with the flexibility they need to make day-to-day decisions and implement long-term management and operational policies.

The Public/Private partnership proposes the following objectives for the future management structure of the Muddy River project. The Public/Private partnership would be dedicated to:

1. Unified quality performance standards for restoration and maintenance. (These standards will be monitored by the EIC.)
2. Seamless care of the parks system– the park system would be perceived as a landscape without borders.
3. Effective completion of the Muddy River Restoration Project in the short-term as well other Emerald Necklace restoration efforts in the long-term.
4. Protection and upkeep of investments in the Emerald Necklace park system over time.
5. Developing a workforce with the specialized expertise necessary to meet the unified quality standards to care for the historic and natural landscapes.
6. Providing a safe, comfortable and positive environment for the public throughout the system for all seasons.
7. Ensuring sufficient and consistent public funding streams.
8. Helping to leverage significant private resources in support of the park system.

The ENC would have a five-part role in the Public/Private partnership structure:

1. ***Signatory*** – to the Memorandum of Agreement between the public agencies and the ENC.
2. ***Convener and Facilitator*** – of signatories to the MOA to:
    a. Identify priority projects
    b. Developing timelines and programs for implementation of projects
    c. Review and address strengths and weaknesses of partnership activities
3. ***Coordinato***r – of consensus building around Emerald Necklace constituents and related organizations
4. ***Resource provider*** – of funding, in-kind contributions and other financial or volunteer resources in support of the Emerald Necklace's restoration, management and programming.
5. ***Advocate*** – for the Emerald Necklace park system.

ENC would further work to coordinate and facilitate the inclusion of institutions in the project area in maintenance activities, organize special projects in the park area and advocate funding for the park from various sources.

An Implementation Team consisting of the staff within the City, Town and MDC would support the Public/Private Partnership. The Implementation Team would be those actually conducting the maintenance and management of parkland and waterway resources. A description of the Implementation Team is included in Section 6.2.4.

6.2.4 Role of Regulatory Agencies and Committees

All the members of the partnership are represented on the Environmental Improvement Committee. The proponents and ENC sit on the Technical Advisory Committee. The ENC also has a seat on the Citizens' Advisory Committee. Each of these committees has a distinct role, and each will inform how the partners make day-to-day decisions and implement long-term management and operational policies.

For the purposes of inclusion and cooperation the Regulatory Agencies will be addressed as a Regulatory Group. The Group will consist of the Executive Office of Environmental Affairs (EOEA), the Massachusetts Environmental Policy Act (MEPA) Unit within EOEA, the Department of Environmental Protection (DEP), Massachusetts Historical Commission (MHC) and other permitting agencies such as the City of Boston and Town of Brookline Conservation Commissions and historical commissions. The active participants of the regulatory group may vary by construction contract depending on the permits and approvals applicable to each construction contract. The federal, state, and local regulatory agencies are expected to carry out their responsibilities within each one's current management and administrative framework under their own regulations, policies, and procedures. The regulatory group is responsible for ensuring compliance with applicable regulatory programs including the MEPA process, required permitting, and fulfillment of Section 61 Findings.

In addition, three committees were created during the regulatory process:

Citizens Advisory Committee. The CAC, whose members represent a diverse range of backgrounds, experience, and affiliation, provides public input on the full range of environmental issues both to the proponent, as it prepares MEPA submittals, and to the EOEA, as it reviews the submissions. (See Table 6-1 for current CAC members.) The CAC was established by EOEA to serve as advisors to the Secretary on the project. Following the submittal of the FEIR, the CAC will receive annual updates from the project proponents regarding the status of the Muddy River improvements. The CAC's role extends beyond the Muddy River project as advisors to the Secretary on the entire Emerald Necklace for aspects of the Emerald Necklace Masterplan that need review under the MEPA process.

Table 6-1

Emerald Necklace Citizens Advisory Committee

Member Organization	Current Representative
Boston GreenSpace Alliance	Kay Mathew
Boston Resident	George Proakis
Brookline Conservation Commission	Kate Bowditch
Brookline GreenSpace Alliance	Tina Odddleifson
Brookline Resident	Edward Cutler
Charles River Watershed Association	Margaret Van Deusen
Emerald Necklace Conservancy	Arlene Mattison

Fenway Alliance	Kelly Brilliant
Fenway Civic Association	Fredericka Veikley
Fenway Garden Society	Marion Sabal
Fenway Studios, Inc.	George Hagerty
Friends of Leverett Pond	Hugh Mattison
Friends of the Muddy River	Isabella M. Callanan
Friends of the Muddy River	Frances J. Kemp
Historic Massachusetts Inc.	Jim Igoe
Jamaica Pond Project	Christine Cooper
National Association for Olmsted Parks	Arleyn A. Levee
National Park Service	Charles Alan Birnbaum
ROW Coalition	Edward Burke
The Abbey Group	Alan Goodman
Member	Lauren Meier
Member	Suzanne Comtois
Member	Frances Allou Gershwin
Member	John Leahy

Technical Advisory Committee. The TAC is comprised with members having considerable technical knowledge in all areas of importance to the project, principally federal, state and local agencies with regulatory authority. (See Table 6-2 for current TAC members.) The TAC is the forum for addressing detailed technical issues on project permitting, design, and implementation. The TAC would provide technical support to the Public/Private Partnership and Project Implementation Team.

Table 6-2

Technical Advisory Committee

Member Organization	Current Representative
Boston Conservation Commission	Tim Famulare
Boston Parks and Recreation Department	Margaret Dyson
Boston Office of Budget Management	Richard Sylvia
Department of Environmental Management, Division of Waterways	Gene Cavanaugh Nancy Thornton
Department of Environmental Management	Richard Thibedeau
Emerald Necklace Conservancy	Simone Auster
Fenway Alliance	Kelly Brilliant
Fenway Alliance	Jack Malone
Massachusetts Emergency Management Agency	Cris McCombs
Northeastern University	Jack Malone, Chair
Town of Brookline	Tom Brady
Other Attendees	
Proponents' Project Manager	John Burckardt
Camp Dresser & McKee Inc	Bruce Conklin
US Army Corps of Engineers	Richard Heidebrecht

Environmental Improvements Committee. In letters dated May 21, 2002 and July 1, 2002, the proponents agreed to support a Muddy River Environmental Improvements Committee (EIC) that would serve as an independent oversight body for the Muddy River Restoration project. The composition of the EIC is outlined in Table 6-3.

Table 6-3

Emerald Necklace Environmental Improvements Committee

Member Organization	Current Representative
Boston Green Space Alliance	Kay Mathew
Boston Society of Landscape Architects	Paula Cortez
Brookline Green Space Alliance	Arlene Mattison
Charles River Watershed Association	Kate Bowditch
Fenway Alliance	Kelly Brilliant
Emerald Necklace Conservancy	Simone Auster
Emerald Necklace Technical Advisory Committee	Jack Malone
Emerald Necklace Citizen Advisory Committee	Ed Burke, Frances Allou Gershwin, George Proakis, Arleyn Levee
Ex Officio Members	
Boston Landmarks Commission	Ellen Lipsey
Boston Parks & Recreation Department	Antonia Pollack, Margaret Dyson
Brookline Preservation Commission	Dr. Gary Gross, Greer Hardwicke (alt)
Brookline Parks & Open Space	Erin Chute
Department of Environmental Management	Patrice Kish
Dept. of Environmental Management, Division of Waterways	Ben Lynch
Division of Fisheries & Wildlife	Mark Tisa
Executive Office of Environmental Affairs	Betsy Shure Gross
Massachusetts Emergency Management Agency	Cris McCombs
Massachusetts Historic Commission	Cara Metz
Metropolitan District Commission	Samantha Overton Bussell

As an independent entity, the EIC will "participate in the development of performance standards and review benchmarks to monitor progress; provide independent review on a periodic basis to evaluate efforts to meet the project goals, including long-term maintenance and management goals, monitor and evaluate compliance with the provisions of federal, state, and local permits and approvals; and promote close coordination of project activities among Boston and Brookline agencies, the MDC, and the MBTA" (page 8 from 7/29/02 FROD).

Participants in the Public / Private Partnership are also members of the EIC so that the Public / Private Partnership will work through the EIC to coordinate the management and maintenance efforts for the project.

The EIC will develop its own meeting schedules, activities, and systems over time. The proponents have made the following funding commitments: The Town of Brookline is committed to $20,000 per year. The City of Boston has agreed to the original $20,000 plus an additional $15,000 from capital project dollars. This funding will be available upon a positive decision by the Army Corps of Engineers. The Boston Parks Department will also include $35,000 request in the Department's fiscal year 04 operating budget to ensure funding if the decision from the Army Corps of Engineers is further delayed after July 1. It should be noted that the request of

operating funding must be approved by the City Council. These commitments, combined with the $20,000 committed by the Secretary's office through Betsy Shure Gross, will meet the budget set by the EIC.

The proponents and EIC have met the conditions set forth by Jay Wickersham in his August 21st letter. A detailed description of this is available in the proponents' November 27 letter to MEPA (see Appendix B).

Implementation Team - Parkland Maintenance

Parkland maintenance falls under the responsibility of Boston Parks and Recreation, Brookline Parks and Open Space and the MDC. These agencies provide dedicated work crews for specific areas to ensure continuity in carrying out maintenance activities.

Boston Parks and Recreation property maintenance is under the direct oversight and management of the General Superintendents for Horticulture and Trades. Under their direction is the regional park crew, horticultural crew and crew foremen for the Muddy River area, to be supplemented by additional workers having specialized skills in woodlands and wetlands maintenance.

Brookline Parks and Open Space property maintenance is under the direct oversight and management of the Operations Manager. Under the Operations Manager are maintenance crews - including general landscape maintenance, forestry, trades, and litter removal crews - dedicated to the Olmsted and Riverway area.

MDC property is under the overall management of the Deputy Commissioner of Operations and under the direct supervision of the Charles District Superintendent. Under his direction are maintenance crews and crew foremen for the Muddy River area.

The MDC has suffered extensive budget cuts affecting their ability to meet their existing maintenance responsibilities, let alone additional responsibilities. The ability of the MDC to meet the additional maintenance responsibilities resulting from the completed Muddy River Restoration Project is questionable without a substantial increase in their operating budget. The City of Boston and Town of Brookline should support the MDC in its efforts to increase its operating budget.

Collectively, the Boston Parks General Superintendent, Brookline Operations Manager, and MDC Deputy Commissioner of Operations represent the maintenance managers and Implementation Team for each entity under the Public/Private Partnership. They would also meet to work on implementing the goals and policies set out by the partnership. Horticulturists, arborists and crew maintenance supervisors will work with maintenance managers to advise on setting policy and meeting goals.

Implementation Team - Best Management Practices

Improvements outside the parkland areas are principally BMPs that will be owned or conducted by several parties such as the Boston Public Works Department, BWSC,

MDC, the Town of Brookline and the Brookline Department of Public Works, the Massachusetts Turnpike Authority (MTA), and the Massachusetts Highway Department (MHD). The goal for outside parkland work is that signatories to the MOU will meet their maintenance and implementation commitments and work to coordinate their activities through the management group. As new BMPs come online, the management group and each entity will reach a consensus to establish maintenance procedures and the entity will report results so the management group can complete the Annual Update Report for MEPA.

Meetings and Review Sessions
A regular schedule of Public/Private Partnership meetings between the ENC, Boston, Brookline and the MDC will take place to coordinate efforts. The schedule of the meetings and reviews would be the subject of the MOA and generally include:

- Planning and policy meetings several times a year with staff at the Commissioner / Director level from the Partnership. These would review progress to date and establish goals and programs for succeeding years.
- Prepare and review the Annual Update Report for MEPA and reporting to the EIC, CAC and TAC.
- Coordination meetings between Operations Managers, General Superintendents and Deputy Commissioner of Operations to coordinate maintenance activities and standards between park maintenance sections.
- Participation in the CAC review of the Annual Update Report for MEPA.
- Prioritizing projects for the next year.

6.2.5 Summary of Alternative Management Structures

The Draft EIR presented several alternative management structures that formed the basis for discussions and left the selection of the management alternative until the Final EIR. The selection of the Public/Private Partnership developed from the alternatives in the DEIR and then re-evaluated, modified and added to those alternatives in the Final EIR. Formulation of the alternative management structures was based on identifying several options available under Massachusetts' regulations and also canvassing several other park management organizations across the country. None of the example organizations identified (Prospect Park, Central Park, Louisville Park, Pittsburgh Park) was comprised of multiple jurisdictions as in the case of the Muddy River, so that direct analogies are difficult. The following management structures were described in the Draft EIR:

- Existing Management Structure (status quo)
- Cooperative Management Structure
- Public/Private Partnership;

- Entity Under the Environmental Joint Powers Act; and

- Park Commission or Authority.

Justification for Selection of the Public/Private Partnership

The Existing Management Structure was not selected since it did not address the need for consistent and coordinated planning among the responsible entities. The Cooperative Management Structure was not selected because the CAC objected, asking instead for a greater, on-going role for the private sector in the management of the park system. A Park Commission or Authority was not selected since the proponents are not in a position to cede control of a portion of their public parklands over to another authority.

The option of an Environmental Joint Powers Agreement generated a great deal of interest; however upon review it did not offer substantive advantages and did present several significant disadvantages. The authority to commit to a partnership arrangement already lies with the proponents outside of MGL c.21A, Sec 20. Even if municipalities use the Joint Powers Act, such a commitment may not go beyond legal limitations on an entity's authority to dedicate funds without legislative appropriation or other relevant authority. A carefully crafted Memorandum of Agreement (MOA) gives the parties complete control over the terms to ensure that the commitments being made are in fact legal and in line with statutory authority regarding allocation of financial resources and personnel. An agreement under the Joint Powers Act would require legislative approval if it is to continue for more than five years, a period far briefer than the life of Muddy River project elements. And finally, a private entity cannot be a formal part of any arrangement under an Environmental Joint Powers Agreement. This would severely limit the role of any party that could potentially commit to a partnership arrangement with the public entities involved and be made a formal part of this arrangement.

In reviewing the possible management structures, several criteria were critical to the selected structure. These are the ability of the current park agencies to retain ownership and maintenance responsibilities, as well as the ability to include administration of funds from public and private sources. Other considerations are also important in comparing structures although they don't really fit the definition of criteria. Table 6-4 summarizes the criteria/considerations and compares these considerations by management structure.

In every case, regulatory authority (i.e. responsibility for ensuring that the requirements of the Certificate from the Secretary of Environmental Affairs are met and that compliance with regulatory programs is maintained) remains with the Executive Office of Environmental Affairs (EOEA) and the Department of Environmental Protection (DEP).

Each structure is summarized below, with further discussion than was provided in the Draft EIR.

Table 6-4

Summary of Management Structure Criteria and Considerations

Criteria or Consideration	***Existing Management Structure***	***Cooperative Management Structure***	***Public/Private Partnership***	***Entity Under Environmental Joint Powers Act***	***Park Commission or Authority***	***Cabinet Organization***
Administer funds from public and private sources	Y	Y	Y	N	P	Y
Existing park agencies retain ownership and maintenance responsibilities	Y	Y	Y	Y	N	Y
Creates single entity to manage parks	N	N	N	N	Y	N
Coordinates maintenance through joint meetings of managers/ proponents/ management team?	P	Y	Y	Y	Y	Y
Mixture of Public and Private entities included in management structure	N	N	Y	N	N	Y
Requires change in State legislation, approval by City Council or approval by Town Meeting to create	N	N	N	Y	Y	P
Requires MOA among entities	Existing	Y	Y	Y	Y	Y

Y – Yes
N – No
P - Possibly (assumes enabling legislation includes the provision)

Existing Management Structure

Under the existing management structure, the City of Boston, Town of Brookline and the Metropolitan District Commission (MDC) each maintain a portion of the project area and are individually responsible for staffing and funding this work. There is no structure in place responsible for coordinating or assuring that ongoing maintenance is done to a specific set of standards or practices.

Under the current management organization there is little coordinated maintenance in the Muddy River area with only informal cooperation among the park crews and supervisors. The result is non-uniformity within the system.

Cooperative Management Structure

The cooperative management structure for managing the Muddy River area would be comprised of the City of Boston, the Town of Brookline, and the Metropolitan District Commission (MDC), each continuing to maintain its respective portion of the park in concert with a unified plan. In the cooperative management structure, a senior representative of each entity with parkland responsibilities would meet and set policies and goals for work inside the project area, parkland (park maintenance) and for related work outside the parkland (principally BMPs). These representatives would be Commissioner/Director level at each agency and have the ability to commit resources or influence the commitment of resources to the management and maintenance effort.

The Cooperative Management Structure passed the critical selection criteria and, in general, compares favorably with the other management structures when looking at the other selection considerations. Subsequent to the DEIR when the CAC had unfavorable reactions to the Cooperative Management Structure, the proponents considered how to strengthen the private component of the management structure. The public/private partnership structure essentially improved on the cooperative management structure.

Public/Private Partnership

The Public /Private Partnership is the selected management structure and was developed after refining the concepts in the DEIR and considered the work on management structures being conducted by the Emerald Necklace Conservancy.

Public/Private Partnerships (Partnerships) can take many forms depending on the relationship and involvement of the relevant parties. In the other park management organizations studied, the park system was located within one municipality, although management responsibilities were sometimes shared with a number of city departments. A summary of existing Partnerships (Central Park and Prospect Park in New York, Louisville's Olmsted Park and Pittsburgh's parks) is included in the DEIR.

Key to the ability for a Partnership to exist is the interest and ability in a private group to take a leadership position to improve the park organization. In Boston and Brookline the private umbrella organization taking a leadership role in park stewardship is the Emerald Necklace Conservancy (ENC). The City of Boston, Town

of Brookline, MDC and the Emerald Necklace Conservancy would be partners in the Public/Private Partnership.

The Public/Private Partnership would be based on a carefully prepared Memorandum of Agreement outlining the roles, responsibilities and procedural interaction for the parties. The MOA would allow the participating organizations to completely describe the terms and commitments of the parties, would be legally binding (after approval, affirmation or execution by the participating parties) and would take into account the existing statutory authority of the parties regarding allocation of financial resources and personnel. The MOA would clearly outline the individual and collective responsibilities of each member of the Public/Private partnership (City of Boston, Town of Brookline, MDC and ENC) with regard to their sections of the park and the system as a whole. This MOA is separate from the MOU that the parties will negotiate to document the financial commitments relating to funding of the capital costs of the project by the proponents and funding agencies. The MOA would obviously incorporate the provisions of the funding commitments and therefore cannot be fully developed until the financial commitments from the Army Corps of Engineers are clarified. The MOA could also be amended in the future as the partnership evolves by agreement of the parties.

In addition to the roles of Boston, Brookline, MDC and the ENC in the partnership, the partnership would be advised in its actions by other entities having interests in the park management such as the Environmental Improvements Committee, the Emerald Necklace Citizen Advisory Committee and the Emerald Necklace Technical Advisory Committee. The distinct role of these committees is outlined in previous part of this section.

The advantages of the Public/Private Partnership as described would be that the existing owning agencies retain ownership of their park areas but there would be a central body coordinated by the ENC to provide more uniformity and accountability to park maintenance. The MOA between partnership entities could address sharing of resources and sharing of funding while still maintaining the statutory requirements that exist for each entity. In and of itself, the partnership does not resolve the individual governing bodies budget constraints, however the revised MOU will formalize the funding commitments of the participating agencies.

Entity Under Environmental Joint Powers Act

Section 20 of Chapter 21A of the General Laws of Massachusetts allows two or more public agencies to enter into an agreement to jointly exercise certain powers and duties over specific areas or regions. The intent of the “joint powers agreement” is to facilitate intergovernmental action on natural resource and environmental issues. This structure is designed to overcome the inability of participating public agencies to expend funds within another jurisdiction. The agreement must specify: 1) the purpose and nature of the agreement; 2) the duties and responsibilities to be shared and how they will be divided; 3) the estimated costs and methods of financing; 4) the method of administration; and 5) the duration of the proposed agreement. The agreement may last for up to 5 years and requires legislative approval for extension beyond that time.

A board comprised of at least one member of each participating agency may administer the joint powers agreement. The board would coordinate the activities of the participating agencies but only to the extent of the powers that the participating agencies already are granted by law. There is no management authority over funds, land or resources beyond those already exercised by the participating agencies. The commitment of budget and resources may not go beyond the legal limitations of the joint powers entity without legislative approval or other relevant authority.

For example, in the agreement for the Upper Mystic River Watershed Agency, there is specific language that indicates that no member community is required to provide funding or pay assessments for agreement obligations unless the funding is authorized by the lawful appropriating agency of the member community. This provision has the effect of limiting the organization to only expend money already appropriated and provided. Joint Powers agreements cannot require funding work based on an anticipated assessment that may not materialize.

Advantages of the Environmental Joint Powers Agreements include the ability to appropriate money in several jurisdictions and to expend the money in member jurisdictions in ways that benefit the overall park system. It also provides a centralized organizational structure for the purpose of administering the agreement.

Conversely, the Environmental Joint Powers Agreement does not specifically provide the ability to create a dependable revenue source that can be administered by the agency. The revenue source is subject to the appropriations of the member organizations. Additionally, the agreement cannot include private parties, while the success of the Muddy River restoration is contingent on the input and involvement of private entities such as the ENC.

Another disadvantage of the Environmental Joint Powers Agreement is its inability to commit trust resources in the park areas. Some of the funds available to the proponents are part of trust agreements and are the source of discretionary funds that can be used to address projects of special interest. The trust agreements expressly limit the discretion of the proponents as to the use of the funds. The agreements do not allow for transferring the authority for allocation of those funds to another entity.

Finally, the Joint Powers Agreement is limited to 5 years in duration without legislative approval which is significantly shorter than the Muddy River project. Legislative approval is not necessarily guaranteed.

Park Commission or Authority

Under Massachusetts General Law, certain Commissions or Authorities can be formed for the purpose of administering an organization dedicated to a specific public purpose. Special legislation can also be filed to form these Commissions or Authorities that are not specifically outlined in the MGL. The actual organizational structure of these commissions or authorities can vary significantly and are a function of the legal negotiations of the parties agreeing to form the organization. In simple terms, a commission or authority is a central organization with a structure separate

from the towns and cities involved. There can be representation of the current organizations or completely separate structure in the commissions and authorities.

Commissions or authorities also require the establishment of an independent revenue stream to support their organization. This is generally a contentious legislative issue. Most authorities are created with a dedicated revenue stream and provisions for adjusting that revenue stream to meet expenses. An example is the Massachusetts Water Resources Authority (MWRA), which raises revenue through user fees for the services provided and independently sets those rates. The Massachusetts Bay Transportation Authority (MBTA) similarly raises its own revenue, however it has the authority to assess member communities for the costs to provide service. A third example is the Metropolitan District Commission where the MDC relies on the legislature to provide funding for operations in an annual budgeting process. This last example is clearly subject to the competing interests of the overall funding authority.

Another reason that authorities or commissions are formed is to separate the debt service for a particular project from the current agency. In cases where there is significant new capital funding required, the debt service may place undue burdens on the existing agency especially if there are competing debt needs. In the case of the Muddy River Rehabilitation Project, significant funding would come from federal and state agencies and the debt funding would not be as critical as it would if the proponents were trying to fund the program entirely.

An advantage of the commission or authority organization is the potential to form independent central authority over the park areas. Centralized authority would allow for the creation of common standards and maintenance operations (although this may not be the only way to create common standards and goals). While the funding provision of the enacting legislation would almost certainly be very contentious, presumably once a funding structure is in place it would ensure some consistency in funding operations. Under an authority or commission the owning agencies would have to cede their authority and probably ownership of the park areas. The existing owning agencies may retain some influence over the authority or commission if the board consists of members representing each of the current owners. Ultimately the success of a commission or authority would hinge on the clear benefits to the existing operating agencies to support a legislative process.

Cabinet Organization

An alternative management structure was suggested in a preliminary form by Clarissa Rowe as part of the work with Tim Marshall in documenting organizations in other Olmsted parks and potential maintenance structures. Rowe proposed an Emerald Necklace "Cabinet" that would include representatives from the three owning agencies (City of Boston, Town of Brookline and the MDC), the EOEA, the Emerald Necklace Conservancy and a representative from the Emerald Necklace CAC or one of the other advocacy groups for the parks. At the time that this was proposed the EIC did not exist. The Cabinet would in effect merge the oversight role of the EIC and regulatory role of EOEA with day-today management. The six-member Cabinet

would review park policies, annual work plans, budgets, ongoing maintenance and funding efforts.

There are some challenges inherent to this proposed Cabinet organization that are important to consider. Some of the proposed models discussed have shown regulatory agencies, advisory bodies, and the proponents in this cabinet with equal authority to set budgets, policies, and work plans. This would be in conflict with the legally established structure of Boston and Brookline. Established local commissions are charged with overseeing the policy development for their respective park systems. Secondly, the proposal to require an approval process for budgets and work plans for the park is in direct conflict with the directive from MEPA which clearly states in the FROD that the property owners will continue to control the parks within their jurisdiction. To further compound this issue, the inclusion of regulatory agencies in a cabinet that oversees budget, policies and work plans would conflict with the regulators role in overseeing the state regulations in the entire park system.

Recognizing that there are some advantages to the cabinet structure, we have taken the beneficial aspects of the cabinet and incorporated them into the preferred Public / Private Partnership structure.

6.3 Memorandum of Agreement (MOA) and Memorandum of Understanding (MOU)

6.3.1 Overview

The Secretary's Certificate encourages the proponents to amend the 1999 MOU to include the MDC as part of the management of the project and to be included in the maintenance of the project area.

There are actually two agreements concerning the Muddy River project that have been executed. A Memorandum of Agreement was signed June 8, 1999 between the City of Boston and the Town of Brookline that detailed the financial and management terms for conducting work on the Muddy River project. (A copy of the Agreement is included in Appendix B.) The Agreement identified the responsibilities for Boston and Brookline in contracting for services and sharing information on the project. There was no specific definition of the level of funding required by either party or source of other funds.

The second agreement was the November 1999 Memorandum of Understanding containing the responsibilities for funding and administering the Muddy River Restoration Project. (A copy is included in Appendix B.) In summary, the MOU identified the City of Boston through its Parks and Recreation Department as the project manager of Phase I of the project including Charlesgate. The City would receive and disburse funds for the project in cooperation with other participating agencies. The MOU indicated that about $7.1 million was necessary to complete the planning, design and permitting of Phase 1 of the Project and the planning, design, permitting and construction of Charlesgate. A specific breakdown of the sources of funding was included. The proponents agreed to accept responsibility for costs of

maintaining and managing the project including implementation of BMPs once Phase I is complete.

These two agreements will be renegotiated as part of continuing work on the Muddy River Project. Two new agreements are anticipated at the end of negotiations. The first is an agreement on management structure and maintenance responsibilities that will include the MDC as part of the agreement. This will replace the June 1999 MOA. The second agreement is a financial MOU outlining the fiscal responsibilities of the parties including the EOEA and U.S. Army Corps of Engineers. The second agreement will replace the November 1999 MOU.

6.3.2 Management and Maintenance Agreement

The proponents and the MDC have met several times to begin drafting an agreement to include the MDC in the management and maintenance planning of the project. Ultimately the form of this agreement is dependent on the final management structure proposed in the FEIR. Progress was made to the point of creating a first draft of the agreement based on the management organization presented and discussed with the CAC on November 20, 2002. There was considerable discussion on the proposed management structure that did not result in a final recommendation. The management structure proposed in this FEIR differs from some of the CAC ideas. A new draft of the management agreement will be made once the proponents receive the Secretary's comments on the management structure included in the FEIR. Negotiations would then continue to finalize this management and maintenance agreement.

6.3.3 Financial Agreement

The proponents intended to craft the financial agreement while the FEIR was being developed with the intention of having an agreement near the time when the FEIR was submitted. Key to this agreement is the level of participation of the ACOE. It was expected that the ACOE decision document would have been reviewed in Washington and released to the public earlier this year (sometime in the summer of 2002) so that an agreement could be based on the information that was made public. This document has not been released yet. The ACOE financial commitment is not necessarily guaranteed based on the information in the public document, however it is the first record of the ACOE definition of the project and expected Corps financial participation. The proponents and the state funding for the project are heavily dependent on the final definition of the project and anticipated Corp funding. Until such time as the Corps information becomes public, the proponents can not make progress on the financial MOU. The proponents will keep MEPA advised on the progress once the Corps document becomes public.

6.4 Maintenance - Accountability and Reporting

In addition to the Management Structure, the future Maintenance commitments to this project are extremely important to the continued viability of the project area and to protect the investment made by many parties in funding this project. In the remaining paragraphs of this Section the overall maintenance program will be

discussed starting with the accountability and reporting by the proponents demonstrating accomplishment of the maintenance commitments. The Section will continue with discussions on the maintenance requirements in the park areas of the project and maintenance of BMP and culverts. Finally, a series of reports demonstrating the future park and environmental conditions resulting from the proponents maintenance activities will be discussed followed by a summary of the costs for providing the maintenance program. The maintenance program discussed in this Section of the FEIR updates and adds to the program in the DEIR.

As part of the commitment to the Muddy River Rehabilitation project, the proponents have demonstrated how they will be accountable for the maintenance and management of the project over the long term. The proponents have signed a Memorandum of Understanding committing to funding the maintenance of the project in return for assistance from the state on capital expenditures for the project. Other commitments include:

1. Certain activities to be accomplished each year will require permitting where state agencies can provide guidance on future activities.

2. A quality assurance program through reports and logs is part of the maintenance program to document maintenance activities.

3. An annual update of progress will be provided to MEPA.

The following paragraphs discuss each of the areas assuring continued commitment by the proponents.

6.4.1 Maintenance Environmental Permits and Approvals

The environmental permits and approvals to be obtained for the Phase I Project include:

- Certificates on the Draft and Final EIRs from the Secretary of the Executive Office of Environmental Affairs (EOEA);

- Department of the Army Permit under Section 404 of the Clean Water Act for the dredging;

- Work in waterbody under M.G.L. Ch. 91 from the Department of Environmental Protection;

- Finding of no adverse effect from the Massachusetts Historical Commission, the Brookline Preservation Commission and the Boston Landmarks Commission in their role as a certified local governments;

- Approval from the Boston Landmarks Commission for work on a Boston Landmark; and

- Orders of Conditions from the Boston and Brookline Conservation Commissions.

It is expected that the conditions and requirements of some of these permits will also include requirements during maintenance (similar to permitting requirements for Charlesgate). Examples include such things as invasive control where work will occur in areas governed by the WPA. Replanting would also come under Conservation Commission jurisdiction. The proponents would be expected to report on the progress of these permit conditions directly to the permitting agency as well as include these actions in the MEPA Annual Update Report (AU).

6.4.2 Reports and Logs – Quality Assurance

As part of meeting the intent of the Certificate from EOEA, a series of logs or monitoring reports will be prepared to document that the project is accomplishing its goals. These monitoring activities, inspection and maintenance documents will be included or summarized in the Annual Update as described in Section 6.4.3.

As part of running a maintenance program, the parks' managers should create a maintenance plan document describing how to carry out the specific maintenance activities discussed in this report. BPRD already has a plan that can be modified. Over time the maintenance plan becomes outdated as practices change or as staff develop better ways of accomplishing the work to be done. This plan should be updated periodically to address the changes in practice.

As part of the maintenance plan, maintenance logs would be created to document that maintenance was completed and if there are any follow up activities that need to take place. A sample of a maintenance log is included as Table 6-5. This is a sample of BPRD maintenance log already being used, and similar logs would be developed for each park maintenance activity by each entity performing maintenance. This log can be developed into simplified electronic database to facilitate use and application for the Annual Report to MEPA. Maintenance logs are the basis of quality control for park maintenance but an overall management review and evaluation of the quality control must be conducted to assure compliance (quality assurance). An example would be the Division Quality Control Program conducted for BPRD.

6.4.3 Environmental Reporting Framework – The MEPA Annual Update

Annual updates to MEPA are required under the Special Review Procedures for all phases of this rehabilitation project. They must be filed annually as a means of informing the Secretary and the public of progress on project implementation, monitoring and effectiveness of mitigation and replanting.

The Annual Update Report to MEPA is the responsibility of the management group for preparation, review and submittal. This report could be prepared by in-house staff and share costs or contracted to an outside consultant. The cost and sharing of costs for preparing this report is estimated in Section 6.10.

6.4.3.1 Environmental Reporting Framework – The MEPA Annual Update

The Secretary, in his Certificate on the Draft EIR stated that the Annual Update would include the information proposed in the Draft EIR and also include the following:

Table 6-5
Sample Maintenance Log

MAINTENANCE REPORT: BOSTON PARKS AND RECREATION

NAME OF PARK:	DATE: / /
MAINTENANCE GROUP TO PERFORM TASK:	
DATE TO BE COMPLETED:	

TASK TO COMPLETE	TASK COMPLETED	TASK S/U INSPECTED	TASK
			Litter Pickup
			Pavement Sweeping
			Leaf Collection
			Infield Raking
			Tot Lot Sand Cleaning
			Catch Basin Cleaning
			Tree Grate Cleaning
			Rolling Of Turf
			Aeration Of Turf
			Top Dress Active Areas
			Top Dress Passive Areas
			Liming ( )
			Fertilization ( )

TASK TO COMPLETE	TASK COMPLETED	TASK S/U INSPECTED	TASK
			Plant Bed Prepartion
			Mulching
			Pruning
			Slice Seeding
			Mowing & Trimming
			Watering
			Weed Control
			MARKING FIELDS
			BRUSH CLEARING
			BRUSH CHIPPING

Foreman Remarks On Work Tasks

Signature: Date Completed: / /

Superintendent Comments on Inspection

Signature: Date Reviewed: / /

Observed Site Conditions Which Need Attention

- Mileposts that clearly measure the attainment of environmental goals and the adherence to environmental performance standards;
- Summary and analysis of reports listed in the Draft EIR Executive Summary;
- A summary of funds expended on the implementation of the project, including the BMP plan and Maintenance and Management Plan, disaggregated by category;
- Budget and funding sources for the upcoming year;
- Summary of monitoring information on current environmental conditions; and
- Copies of Army Corps annual inspection report and Charlesgate annual inspection report, and discussion of any actions taken to address issues raised in the reports.

The Secretary also noted that he anticipates that review of the Annual Update will include meetings with the CAC and oversight body, and possibly additional public meetings.

6.4.3.2 Annual Update Summary

In accordance with the EOEA Certificate on the Draft EIR, the proponents have committed to providing Annual Update to MEPA and the CAC.

Because this is a complex project, the proponents acknowledge that successful implementation will require preparation of numerous plans for construction and ongoing monitoring and reporting during construction. In addition, post-construction maintenance plans and procedures and the long-term measurement of environmental performance standards must be analyzed and documented. These plans, procedures and reports stem from a variety of regulatory and project implementation sources, including commitments made by the proponents in the Draft and Final EIRs and permits issued by local, state and federal agencies for various construction activities. It should also be noted that the plans required during construction would be prepared by the contractor, and the contracting agency would review the plans and make them available as needed. If the ACOE constructs the remaining elements of the project after Charlesgate, they would be responsible to see that these plans are prepared.

The pertinent aspects of these plans, procedures and reports will be provided to MEPA annually. The Annual Update will address all of the items listed above in Section 6.4.3.1 (as stipulated by MEPA) and will specifically include the reports and plans listed in Table 6-6. As shown on the table, some of these reports will either be summarized in or attached to the Annual Update.

The first Annual Update will provide an update on the progress of the Charlesgate improvements and the mitigation effectiveness at that location. The first and subsequent reports will also report progress on the remaining portions of the project

TABLE 6-6

LISTING OF REPORTS AND PLANS TO BE INCLUDED IN ANNUAL UPDATE TO MEPA

Reporting Activities	Source(s) of Requirement / Commitment	Contents	Milepost & Frequency[b]	Responsible Entity	Submit To	Presentation in Annual Update to MEPA
Construction Reports and Plans[a]						
Independent Environmental Monitor Report	2	Audit at permit conditions	As necessary to ascertain compliance with permits	Independent Monitor	DEP	IEM reports summarized annually
Environmental Inspection Report	1, 2	Summary of environmental conditions on site	Weekly	Resident Inspector		
Water Quality Monitoring & Analytical Results	1, 2, 3	Lab Results. Environmental Monitoring & Sampling Plan	Varies	Contractor	DEP	Summarized above.
Sediment Removal and Shipping Record	1, 3	Landfill information and Transportation & Disposal	Prior to offsite hauling	Contractor	DEP	Summarized above.
Supplemental Sampling of Sediment	1, 3	Lab Results	As conducted	Contractor	DEP	Summarized above.
Dredged Material Plan	1, 2, 3	Includes Dredge Work Plan, Flood Contingency Plan, and Dust Control Plan	Once	Contractor	DEP, BCC	Status Update
Stormwater/Dewatering Pollution Prevention Plan	1, 2, 3, 4	SWPPP w/ E&S Plan	Once	Contractor	BCC	Status Update
Spill Management Plan	3, 5	SPCC Plan	Once	Contractor	BCC	Status Update
Maintenance Plan for Filter Fabric	3, 5		Once	Contractor	BCC	Status Update
Flood Contingency Plan	3, 5	In Dredged Material Plan	Once	Contractor	BCC	Status Update
Dust Control Plan	2, 3, 5	In Dredged Material Plan	Once	Contractor	BCC	Status Update
Pest Control Plan	2		As necessary by onsite Resident Inspector	Contractor	Proponent	Status Update
Plan for Monitoring Wetland, Shoreline, and Landscape Restoration	3, 5		Once	Contractor	BCC	Status Update
Traffic Management Plan	3		Once	Contractor	Proponent	Status Update
Post-Construction Reports and Plans (Monitoring and Inspection)						
Maintenance Operations Plans	2		Annually	Management Group	Proponent	Attached if revised
Maintenance Logs	2		Annually	Maintenance Supervisor	Proponent	Summary or attached
BMP Monitoring and Maintenance Logs	2		Annually	Maintenance Supervisor	Proponent	Summary or attached
Pest Control Programs	2		Annually	Management Group	Proponent	Summary or attached
Water Quality Monitoring Program	1, 2, 3	Specifies Contractor's WQ Monitoring Requirements	Varies Annually	Contractor for 2 years Management Group	Proponent	Summary or attached
Report on Plantings	2		Yrs 1, 3, 5 then every 3 years.	Horticulturist	Proponent	Attached
Report on Aquatic and Wildlife Distribution	2		Bi-Annually	Mgt Group/Biologist	Proponent	Attached
Report on Historic and Character Defining Features	2		Annually	Mgt Group/Landscape Arch	Proponent	Attached

[a] Currently applies only to Charlesgate project. Other project elements will be added upon receipt of their construction permits.

[b] Reports and plans prepared "Once" would also be amended or modified if necessary. Changes would be reported in annual updates to MEPA.

Legend for Source(s)	Legend for abbreviations
1 Water Quality Certification	DEP - Department of Environmental Protection
2 Section 61 Findings and/or EIR Commitmen	BCC - City of Boston Conservation Commission
3 Construction Specifications	SWPPP - Stormwater Pollution Prevention Plan
4 Stormwater NPDES	SPCC - Spill Prevention, Control, and Countermeasure
5 Order of Conditions (Boston)	

to be implemented after Charlesgate. In this way, local, state and federal agencies and the public will be kept informed and will have the opportunity to comment on the following:

- The ongoing management and maintenance plan;
- The results of monitoring program and the implementation of BMPs;

The progress of the dredging and other restoration/rehabilitation activities;

- The successes and issues associated with the work;
- Modifications to procedures to correct problems and/or enhance the success of the project; and
- Future plans for additional work that was not addressed in the EIR.

Table 6-7 below provides a proposed outline for the Annual Updates required under the Special Review Procedures. They must be filed annually as a means of informing the Secretary and the public of progress on project implementation, monitoring and effectiveness of mitigation and replanting.

Table 6-7

Proposed Scope of the MEPA Annual Update

1.0 General

 1.1 Project Description

 1.2 Provide a list and description of project work (construction, planning, maintenance or BMPs) and the Phase that was accomplished in the previous year under each of the Project Objectives. Also include deferred work.

 1.3 Summary status of applicable reports and plans listed in Table 6-6.

 1.4 Provide a list and description of project work and the Phase that is to be conducted in the following year including deferred work for each of the Project Objectives.

2.0 Environmental Mitigation

 2.1 Describe the environmental impacts that are anticipated in the following year's work for each of the Project Objectives. Summarize the mitigation measures in place or planned.

2.2 Provide a description of the success of the Environmental Mitigation and how it is or, is not, meeting the Project Objectives, any failures and significant observations that were made during the monitoring.

2.3 Describe any modifications to the Environmental Mitigation that would make it work better.

3.0 Management and Maintenance Plan

3.1 Describe any changes that have taken place to the Emerald Necklace management structure over the past year.

3.2 Provide a tabular summary of the effectiveness and success of the growth of new trees, shrubs and wetland plantings.

3.3 Document any decrease or increase in fish and wildlife usage of the Project area that was observed by Park Rangers, management, crews and/or biologists every other year.

3.4 Describe the success of the Management and Maintenance Plan in controlling the reestablishment of invasive vegetation.

3.5 Where the survival/growth of new plantings and/or control of invasives was unsuccessful, describe the reasons and proposed modifications intended to address this shortfall.

3.6 Objectively describe any shortcomings and recommendations for the Management and Maintenance Plan.

4.0 Best Management Practices Plan

4.1 List all BMP activities from the proposed DEIR program that have taken place during the previous year, as well as those which were deferred.

4.2 List all BMP activities that are planned for the following year.

4.3 Include the volume (weight) of sand that was removed from each of the grit separator type devices in the watershed.

4.4 Have there been any problems with BMP enforcement over the previous year and what are the corrective actions?

5.0 Environmental Permits and Approvals

5.1 Provide a working list of all in-place environmental permits and approvals that are required to implement to following year's activities.

5.2 Describe any amendments to, or additional permits and approvals that are needed to implement the following year's work.

5.3 Provide any inspection reports required by funding agencies.

6.0 Funding and Schedule

6.1 Provide an overview of the funding status (including budgets, source of funds, and expenditures) and implementation schedule for the following year's work.

7.0 Response to Agency and Public Comments

7.1 Provide a summary of responses to public comments that were received on the previous public document and a summary of public outreach efforts during the previous year. The Annual Update will be discussed with the CAC.

6.5 Park Maintenance Plan

6.5.1 Summary

The full maintenance plan is presented in Appendix H and is summarized here. The purpose of the plan is to recommend standards to guide the maintenance of the Muddy River Parks of the Emerald Necklace, map the park areas, and estimate the equipment and labor needed to meet those standards. The plan has been simplified to a series of maps indicating physical maintenance areas accompanied by a straightforward description of overall maintenance activities and frequency. The simplified plan is meant to be used directly in the field by supervisors and foremen.

The plan divides the park into seven geographic sectors for analysis and planning purposes - taking into account responsibilities and the physical settings. The sectors are:

- Sector I Charlesgate
- Sector IIA Back Bay Fens North: Victory Gardens/Mother's Rest
- Sector IIB Back Bay Fens Central: Rose Garden/Clemente Field
- Sector IIC Back Bay Fens South and Sears Parking Lot
- Sector III Riverway
- Sector IVA Olmsted Park North: Leverett Pond/Daisy Pond
- Sector IVB Olmsted Park South: Wards Pond/Willow Pond/Nicholson Hill

The physical areas in the park were also divided into three categories to account for the varied and complex landscape:

- Natural Areas – open, natural areas subdivided into woodlands, parkland/turf, water/watercourse, and gardens;
- Paved Areas – open to the elements, but covered by a manmade surface, including parking lots, playgrounds, paths, etc.;
- Structures – enclosed or partially enclosed areas subdivided into buildings, monuments, and drinking fountains.

About half of the park area is comprised of water and turf/parkland, with the remaining half divided between paved areas, woodlands, and planting areas, in decreasing order of percent cover.

Using this system of categorizing the park geographically and physically, park maintenance standards were developed by physical area. From interviews with park managers and field observations, the following priorities for park maintenance were also developed: additional cleaning, arboriculture (tree management), water body management and related horticulture, turf care, horticultural care, and erosion control.

The estimated workload (in annual person hours) to maintain the park, taking into account the current maintenance standards, proposed higher standards, impact of capital projects, and levels and priorities for maintenance, is higher than the currently available person hours. The estimated hours needed for maintenance by task and sector are presented in Appendix H. A summary is presented below.

Table 6-8

Summary of Annual Maintenance Hours

	Hours at Current Standards	*Hours at Higher Standards*	*Estimated Total Hours*
Boston	8,387	20,283	28,670
Brookline	3,155	5,095	8,250
MDC	1,562	5,283	6,845
Totals	13,107	30,661	43,765

Note: Hours are totals of Net Productive Time for field staff and do not include supervisory or management staff.

The maintenance plan in Appendix H also includes a schedule identifying the time of year for each maintenance task.

6.5.2 Meeting the Increased Maintenance Needs

The estimated increase between current available productive hours and the needs for the maintenance hours for higher standards and new work is about 30,700 hours or about 20 full time equivalent staff (FTEs). Approximately 13,800 of these new hours are for new work in the park such as the new daylighted areas, embankment plantings, woodland maintenance and watercourse maintenance.

Nearly 12,500 hours of the increased work are for woodlands, park canopy pruning, wetlands and watercourse maintenance. BPRD and the MDC will in all likelihood be contracting these services to outside vendors since the current staff do not have these skills. This would mean about 10,200 hours in tree and waterway maintenance would be contracted to private vendors or about one third of the total increased hours.

In the short term, before the construction for the project is completed and the two year maintenance agreement for the contractor expires, there is a more modest gap in staffing that can be filled gradually by new staff. The new staff should be obtained possessing skills the will be needed as the overall workload increases at the end of the two year maintenance period. By taking the overall additional staffing needs (30,700 hours) and subtracting the new work (13,800 hours) and the contracted work (10,200 hours), a modest total of about 6,700 hours are needed to maintain the current park areas at a higher standard of care. This is equivalent to about 4 more full time staff. These additional staff would be hired between now and the end of the construction maintenance period or over about 4 to 5 years. As part of fulfilling this short term gap the proponents are already participating in joint training at the Arnold Arboretum to increase staff skills.

At the end of the contract maintenance period in 4 to 5 years the proponents will have to provide for the anticipated new work of about 13,800 hours. This is expected to be a combination of staff and contract services. The timing of these needs allows time for the proponents to work with the city and town administrations to plan for these increased needs in future operating budgets. Some of the need for new hours are expected to be offset by the participation of organizations along the Muddy River in maintaining portions of the park opposite their facilities. This participation is expected to be coordinated by the Emerald Necklace Conservancy as part of their role in the Public / Private Partnership.

6.6 Monitoring and Maintenance Practices – Culverts and Best Management Practices

As new culverts are constructed under the project, monitoring and maintenance will be required to assure the facilities operate at full capacity to pass storm flows.

Once new BMPs are implemented and existing BMPs are improved, a monitoring and maintenance plan must be followed to evaluate and ensure the effectiveness of the BMPs and to reduce the need for future capital costs. For new structural BMPs, maintenance involves inspection and cleaning at regular intervals. If proper maintenance is carried through, the project life of the new systems can be maximized.

6.6.1 Culvert Maintenance

Existing culverts in the project area are maintained by BWSC, Brookline Public Works Department or the MDC. The proposed project improvements will not change this arrangement and will probably lower maintenance requirements through improved design.

Culvert maintenance consists of two major activities; clearing accumulated debris or sediment and repairs to the structures. In Section 6.7.1 preventative inspections prior to major storms are described. This type of inspection should also occur twice per year outside of specific storms. When blockages are discovered they should be cleared.

One time per year the culverts should be inspected for structural conditions to be sure no cracks, erosion, or settlement has occurred that may compromise the operation of the culvert.

In the future, Boston and Brookline will be responsible to maintain all culverts in the park area except those under the MDC roadways.

6.6.2 Maintenance of Source Control BMPs

The source control BMPs discussed in Section 5 all require some level of maintenance. With the new catch basin cleaning and maintenance program, BWSC will have a more comprehensive database including information such as the location, structural integrity, and sediment deposition rate of each catch basin. This should streamline the cleaning and maintenance processes and make it easier for crews to clean catch basins as part of a regularly scheduled program. An important component of Boston's new catch basin database is to keep it updated by documenting in the database when new construction occurs such as when catch basins are paved over or new catch basins are added.

As part of the recommended BMP maintenance program, Brookline would update its database with the condition of the catch basins, which would help the Town monitor a regular catch basin cleaning program. Brookline already has a regular cleaning program and the database will help refine the program based on sediment accumulation. The MDC currently has no catch basin cleaning data program and its maintenance crews clean the catch basins on an irregular basis. The MDC would improve the frequency of their catch basin cleaning as part of their BMP maintenance requirements.

Maintenance of the street sweeping programs is another key component in an effective long term BMP program for the Muddy River watershed. Annual budgets must factor in maintenance costs and the costs of new trucks and equipment for street sweeping. Boston and Brookline will be the responsible for streets they own in the watershed. Boston will be working with the Boston Transportation Department to implement improved towing policies to assist in improving the street sweeping program. The MDC is also recommended to augment their existing street sweeping program and provide sufficient budget to complete this activity.

Once the desire lines are corrected (by planting or establishing path surfaces) in the Riverway and the Back Bay Fens, the maintenance program would include trail maintenance as needed. Replanting of grass and vegetation where used every spring or fall would prevent large efforts every couple of years and will provide an overall aesthetic experience for park users. Maintenance of desire lines would fall under the responsibility and budget for overall park maintenance.

A final recommended maintenance measure for source control BMPs is public education. The sections of Boston and Brookline which abut the Muddy River are, in many cases, transient. The population changes frequently. An ongoing public education program covering all aspects of source control BMPs is needed to ensure current and future residents understand their role in protecting their waterways and prevent potential flooding problems. As mentioned in Section 5, ongoing public education efforts should include information on herbicide and pesticide use management, proper disposal of litter, pet wastes, and household hazardous materials. The public education program costs should be split by contribution to watershed as identified in Section 5.

Two other items that could be considered source control are discussed in other sections. The pest and rodent control, including waterfowl control, are discussed in Section 6.8 and the Annual Water quality Monitoring Plan is discussed in Section 6.9.

Two additional source control measures listed in the DEIR do not add costs for operation and maintenance. A catch basin labeling program for new and repaired catch basins would be implemented by policy by the MDC to match Boston's and Brookline's programs. The stormwater and park regulations would be reviewed by Boston and Brookline to strengthen current regulations.

6.6.3 Maintenance of Treatment Control BMPs

6.6.3.1 Vegetated Swales

Maintenance requirements for vegetated swales included regular mowing of the grass, no shorter than twice the design flow depth (typically 4-6 inches). Swales should also be inspected monthly to check for excess sedimentation and signs of erosion. If erosion is occurring, stabilization of eroded side slopes and/or bottom is necessary. It is necessary to keep swales free of debris. Damaged areas should be reseeded as soon as possible. Several seasons of planting and re-seeding of sparsely vegetated areas may be needed in order to reach optimum performance (EPA, 1999). Other maintenance requirements for grass swales include de-thatching swale bottom and removal of thatching, discing or aeration of swale bottom, and nutrient and pesticide use management. Also, every five years, proper maintenance requires scraping the swale bottoms and removing sediment to restore the original cross-section and infiltration rate. Currently only one swale is contemplated at the Victory Gardens which would be maintained by BPRD.

6.6.3.2 Particle Separators

For the particle separators that are considered as the recommended alternatives, seasonal inspections are recommended for the first year of operation to establish an

appropriate maintenance schedule. Thereafter, the system is typically cleaned twice annually depending on weather and site activity. For installations in New England, it is recommended that the systems be cleaned just prior to the winter salting and sanding season as one of the cleaning sessions. The Pilot Program for Particle Separators once completed in 2003 will provide additional information on build up of sediments in particle separators to further justify the schedule of cleaning. Responsibility for maintenance would fall to the owner of the outfall.

6.6.3.3 In-Stream Sedimentation Basins

Sedimentation basins, formed by overdredging, require monitoring for sand bar formation every year. The programming for maintenance dredging should be started when the sedimentation has accumulated to approximately 50 percent of the basin's initial capacity. In order to preclude the downstream migration of sediments, the maintenance dredging should be schedule when the basin reaches 50 percent of capacity.

Basin shapes and depths will be measured at the end of the construction. Once per year, a grid will be set up to measure sediment depths at each basin and estimate remaining basin volume. This activity could be conducted by either Boston or Brookline or contracted to a third party. Costs should be shared based on the percent of watershed for Boston and Brookline.

Permitting and construction activities for maintenance dredging would be shared by watershed parties and probably contracted to a third party. It is likely to be a capital cost when needed and should be included in future capital budget plans.

6.6.3.4 Sand Filters

The key to properly maintaining sand filters is regular inspection. Filter beds should be inspected approximately once per month and following heavy storm events. Filter media should be cleaned or replaced as necessary following inspections to prevent clogging. Cleaning of filter beds involves removal of trash, debris and sediments and proper disposal.

When permeability of filter media is reduced, some or all of the sand in the filter bed must be replaced. This should be specified during site design. When the filter bed does not completely drain within 48 hours following a rainfall event, the top layers of media (including topsoil and 2-3 inches of sand) should be replaced. The drainage rate will be monitored once per year. Regular cleaning of filter beds will restore permeability rate and will prolong the life of the beds, therefore reducing the cost of replacement media. (Tennessee BMP Manual). We have estimated replacement at between 5 and 10 years for purposes of maintenance costs.

6.6.3.5 Bioretention Areas

Bioretention areas require frequent mowing and weeding in addition to regular maintenance inspections. At a minimum, during the growing season the area around the bioretention area should be mowed and weeded once every two weeks. Pests should also be extracted from the site during mowing and wedding. Bioretention

areas also require regular inspection and cleaning/removal of debris and sediment. Filter beds should be checked monthly and after heavy rainfall events to prevent clogging.

6.6.4 BMP Monitoring/Maintenance Logs

As each BMP is constructed or implemented, the owner of the BMP will prepare a monitoring/maintenance log. The logs will document the monitoring/maintenance activities. These logs will be summarized or attached as part of the Annual Update Report to MEPA.

The log should consist of a list of the maintenance activities for each BMP including scheduled inspections. A supervisor should initial and date each activity when it occurs. The logs should also include non-scheduled activities that may occur for each BMP.

In the case of catch basin cleaning programs, once the database is generated, a summary of the activities can be reported.

6.7 Corrective and Maintenance Measures following Specific Storm Events

This section of the Management and Maintenance Plan contains a description of preventative, corrective, and emergency actions that are to be conducted preceding, during and following a storm event of a specific magnitude.

Responsibility for preventative and corrective measures would be shared by BPRD, BPOSD, and the MDC. Each agency would be responsible for river segments within their boundaries and culverts under their roadways. BPRD would report maintenance needs to BWSC and BPOSD to Brookline Department of Public Works.

6.7.1 Preventative Measures

Preventative measures prior to large storms should include staff walking along the River doing visual inspections and removing trees or other debris that are blocking culvert or bridge openings. For example, as a result of large storms in the past, significant erosion has occurred due to blocked drains or catch basins. Preventative measures including visual inspections during large storms could limit this type of erosion in the future.

6.7.2 Corrective Measures

In addition to regular maintenance measures in the Muddy River watershed, specific corrective measures need to be undertaken following storms of expected to exceed 4 inches in 24 hours. These corrective and maintenance measures include removing debris from culverts and bridge openings as well as catch basin and storm drain cleaning. The catch basin cleaning programs currently being implemented by BWSC and the Town of Brookline should include provisions for these measures following storm events. It is very important that catch basins that typically experience backup in large storms are inspected and if necessary cleaned immediately following large

storms to remove sediment that has been deposited during the event. In general, catch basins would be expected to operate through storm events and collect debris, however, particularly large events may impact catch basins more than normal storm events and should be checked.

Correction of eroded stream banks and pedestrian trails should also be completed following storms of large magnitude to prevent further erosion. A maintenance form would be completed when correcting eroded banks and trails caused by large storms, based on a routine maintenance and inspection form. Removing debris, including fallen tree branches and litter carried by the storm, is another important corrective measure that must be undertaken by all three entities following large storms.

6.7.3 Emergency Action Plan

A major emergency action plan was developed through cooperation of numerous entities to prevent potential flooding of the Muddy River. The Interim Interagency Plan outlines the steps taken by the MDC, the City of Boston, the Town of Brookline, and the MBTA to prevent flooding of the River in the vicinity of the MBTA Green line. As flood improvement facilities are constructed as part of this project, the level of flooding and back-up issues are expected to be reduced. This plan should be modified once these facilities are completed and experience with new storms shows a new level of maintenance/operational needs. The current plan includes four stages, as outlined in the following paragraphs.

Stage One: The Alert

National Weather Service (NWS) locates a storm that poses a potential flood threat to Southern New England.

Metropolitan District Commission Charles River Dam (MDC) institutes "Standard Operating Procedures for Hurricanes and Storms" (1977).

Boston Parks & Recreation (BPR), Boston Water & Sewer Commission (BWSC) and Brookline Water & Sewer (BRKWS) notify personnel to be on alert for possible staffing, and they monitor NWS advisories.

The Mass Bay Transportation Authority (MBTA) shall institute "Standard Operating Procedure: Muddy River Flood Control (1997) (SOP).

BPRD checks water level in Jamaica Pond, and closes baffles between Jamaica Pond and Wards Pond.

Stage Two: The Warning

NWS forecasts heavy rainfall to occur within six hours in the Boston area and issues a Severe Storm Warning.

MDC begins 24 hour staffing.

BWSC staffs up, opens the gate at the Brookline Ave. Gatehouse to allow the Muddy River to follow its natural course through the Back Bay Fens and through the Muddy River Diversion Conduit under Brookline Avenue.

MBTA dispatches crew to monitor water levels in the Riverway at the culverts, and is prepared to install drop-log dams.

Stage Three: The Operation

One inch of rain has fallen within 3 hours and heavy rain is forecast to continue.

MDC continues to monitor rainfall and maintain river levels according to their SOP.

BWSC dispatches crane to the culverts.

Pooling in the Riverway begins, with water level reaching 110′ MDCB (10′ BCB or 4.45 NGVD).

BWSC crane removes trash grates over culverts.

MBTA suspends trains on "D" line, and installs both drop-log dams.

BRKWS dispatches crew to Brookline Avenue field to monitor access chamber covers to Tannery Brook Drain for movement, indicating surcharge possibility.

Flood water on the tracks. Preparation ends, the battle is joined.

Stage Four: Cessation of Event

NWS advises that the storm has passed. Operations continue until flood threat is over and water levels recede.

This plan also includes an Emergency Notification Form which lists the agencies involved in the Action Plan and the appropriate contact individuals in each agency.

6.8 Pest and Rodent Control

6.8.1 Overview

This section deals with the necessity for controlling such pests as ducks and geese, as well as rodents. In the past several decades, the annual migration of ducks and geese has changed to the extent that these birds remain in many northern ponds and rivers because of the abundance of food from persons feeding them. The ducks and geese have become a particular nuisance because of their continued presence on the banks and surrounding land where they have denuded the ground cover. Feces also impart large quantities of bacteria and nutrients, two water quality constituents that are not needed in already enriched urban runoff waters.

Proactive measures need to be taken to reduce the numbers of ducks and geese in the Muddy River. These may include:

- Public Education;

- Local ordinances against the feeding of ducks and geese (which may involve local agencies such as Boston Inspectional Services or Brookline equivalent);
- The planting of suitable plant species that will form a barrier between the water and land; and
- The implementation of reproductive controls on the goose population by state and federal game officials.

As each of these elements are implemented under the Management Plan, a review of the effectiveness should be undertaken as part of the Annual Update Report and recommendations made for modifying the program as needed. Responsibility for this program cost will be shared by Boston and Brookline based on watershed areas. The MDC is recommended to participate in this activity also based on their share of the watershed area.

6.8.2 Local Ordinances and Public Education

The urban public is as attracted to the flocks of ducks and geese in parks as are the birds to the public. This condition, however, is counterproductive to water quality and ecological stability as well as it is an unnatural intrusion to the bird's instincts. Increasing numbers of municipalities are adopting ordinances against the feeding of ducks and geese to control their population.

Boston and Brookline should consider the adoption of an ordinance against the feeding of ducks and geese, at a minimum at specified locations. The New England Aquarium has sponsored an annual Fresh Water Fair at Leverett Pond. One of the displays could be used to educate the public and to provide pamphlets that inform the public of the problems that are created by the feeding of the geese. Signs will also be posted prohibiting the feeding of geese. However, until there is a local ordinance, there cannot be any enforcement. Periodic notices will published in the local edition of the TAB and other newspapers.

6.8.3 Planting of Natural Barriers

The Preliminary Design Report in Appendix I contains specifications for the planting and maintenance of a vegetative barrier to prevent waterfowl from walking onto the land. Such barriers are the most effective means to control the congregation of waterfowl yet they must be maintained.

The vegetative barrier is most effective because it combines an effective barrier with aesthetic qualities. Vegetative barriers need to become fully established to be effective so maintenance is important until the plants become established. Brookline has used mesh fencing as a temporary measure until plantings are established.

6.8.4 Implementation of Controls

Requests will be made to the Massachusetts Division of Fisheries and Wildlife and the U.S. Fish and Wildlife Service to provide their assistance in controlling the reproductive success of the geese. The control simply involves the spraying of the

eggs with mineral oil which does not allow the eggs to hatch. It may be necessary to repeat the control several times each year.

6.9 Monitoring and Inspections

6.9.1 Water Quality Monitoring Plan

During preparation of the Muddy River Environmental Impact Report (EIR), the water quality of the Muddy River was tested during dry and wet weather events. The monitoring resulted in finding exceedances of the DEP Class B Water Quality Criteria for percent oxygen saturation at the Longwood Avenue Bridge (dry weather conditions), pH in the Daisy Field Drain (first wet weather sampling event – October 6, 2000), and fecal coliform and fecal streptococcus coliform bacteria (during each sampling event) at several locations within the Muddy River system. Based on those data it was recommended that long-term monitoring be conducted as follows.

An annual water quality sampling program consisting of quarterly (seasonal) sampling events. The sampling will be conducted at the following locations:

Within the Muddy River	*Drainage Outfalls*
Commonwealth Avenue	Emmanuel College Drain
Agassiz Road	Longwood Avenue Drain
Boston Gate Houses	Tannery Brook Drain
Fens Bridge	Huntington Avenue
Longwood Avenue Bridge	Village Brook Drain
Outlet of Leverett Pond	Daisy Field Drain
Outlet of Willow Pond	Chestnut Street Drain
Outlet of Wards Pond	

The Town of Brookline and the Boston Water and Sewer Commission independently conduct investigations into conditions within the above drainage outfalls to determine potential sources of non-domestic sewage nutrients when conditions indicate the need.

During each quarter, water quality samples will be collected during a dry period (no rainfall in the past 96 hours, may be reduced to 48 hours if necessary during rainy quarters when a sample wasn't able to be collected), during precipitation, and the day following a precipitation event. The rationale behind this frequency of sampling is to obtain seasonal data preceding precipitation (rain or snow), and to monitor the impact to water quality during and after an event. Therefore, in any given year, up to 12 sampling events will occur at each sampling location.

Samples shall be collected and analyzed by a qualified laboratory for the following parameters:

Sample Parameters	
Fecal Coliform Bacteria	Turbidity
Fecal Streptococcus Coliform Bacteria	Alkalinity
Total Suspended Solids (TSS)	Acidity
True and Apparent Color	Ammonia Nitrogen
Total Phosphorus	Nitrate-Nitrite Nitrogen
Orthophosphate Phosphorus	Metals
	TPH-EPH

Field monitoring for pH, temperature and dissolved oxygen should also be conducted during all sampling.

Data from this monitoring program can be used to monitor the water quality as related to meeting DEP Class B waters and also progress towards reducing sediment loads on the basin. This program is also an excellent candidate for local universities and interest groups to participate as part of educational programs.

The water quality monitoring program is recommended to determine in a coordinated manner the overall health of the water system. Several agencies and organizations are already gathering data for different but similar purposes and if the collection and analysis were coordinated the overall costs could be reduced and quality and usefulness of the data increased. Boston and Brookline would share the cost of the water quality monitoring based on watershed area. The MDC is also recommended to share in this cost on the basis of watershed area. There are several other sources of funding that should be investigated such as state agencies, private groups and universities. University study programs can be used for teaching and source of sample collection and analysis that may be useful for the program. Volunteers like the Charles River Watershed Association may also contribute to this effort.

6.9.2 Observations on the Growth and Success of Shrubs, Wetland and Other Habitat Plantings

One of the requirements for the construction project, as presented in the Environmental Notification Form (Jan. 1999) Phase I of the Muddy River Flood Control, Water Quality and Habitat Enhancement, and Historic Restoration Project, was that Boston and Brookline will maintain the historic and habitat plant materials. In order to fulfill this requirement, it will be necessary for Proponents to develop a report on site inspections made one, three, and five years after planting to assess the success of the effort and to reevaluate and adjust planting efforts as required. Once this inspection program has been established it should then continue on a three year cycle in order to insure the health of these plantings in the future and reported in the Annual Update to MEPA.

The proposed plantings will provide historical restoration, rehabilitation or preservation, improvement of habitat, and increased bio-diversity. In addition, they will provide a practical, sustainable, historical, and ecologically sensitive solution that

needs to function within the management and maintenance capabilities of Boston and Brookline. Many factors can effect these new plantings. Competition from existing plantings, spontaneous invasive vegetation crowding them out, lack of water and nutrients, or light conditions not being optimum due to over-shading are all factors to monitor and record. After planting new trees, the existing tree canopy needs to be continually monitored and pruned annually to encourage better development of the new plantings. Understory plantings also need to be considered when crown thinning and tree clearing.

Also in regard to the historic and habitat plantings, the success rate of the program to control the host of invasive species that are currently overgrowing the Muddy River, such as *Phragmites*, Japanese Knotweed Glossy Buckthorn, Bittersweet, Purple Loosestrife, etc. must also be monitored and recorded. Allowing even a small amount to regenerate will mean that the desirable plantings will quickly be invaded and overwhelmed by these species. Park employees should be trained to identify invasives. Depending on the defined physical park area, invasive species maintenance is conducted monthly, quarterly or annually. Observations of the invasive growth should be made twice per year. For frequency on the management of invasive vegetation, see Appendix F. Responsibility for this activity would rest with the park owner.

6.9.3 Monitoring of Fish and Wildlife Distribution and Reproduction

As the result of dredging of the Muddy River, the removal of *Phragmites*, enhancement of the wetland habitat and fish spawning beds; an improvement in water quality and consequently in the species composition and distribution of indigenous fish is anticipated. This should be evidenced through the presence of more spawning nests for panfish and bass. Pickerel spawning could also be enhanced by placing brush piles underwater. The environmental enhancements to the Muddy River are also anticipated to result in the migration of greater numbers of the blueback herring to Leverett Pond. The blueback herring is an anadromous fish that migrates to fresh water to spawn. Eggs of the blueback herring sink and stick to anything they contact. Good sediment quality is very important for the survival of the eggs. Toxic or highly organic sediments are not as suitable as relatively clean granular (sandy) bottoms. The young return to salt water within a few months of hatching.

In addition, the restoration of an indigenous plant community from the existing mono-typic species, will create a healthy ecosystem containing a variety of plant communities (i.e., diversity) ultimately resulting in the development of significant and valuable structural heterogeneity. This diverse habitat is preferred by a wide-variety of avian, mammalian and invertebrate species. Wading birds such as great blue heron, green heron and black-crowned night heron will take advantage of bank habitat. The interface or edge effect between terrestrial and aquatic environments (the ecotone) provides significant food sources, shelter, breeding and nesting areas for a variety of invertebrates including dragonflies, butterflies and beetles which in turn provide food sources for all growth levels (larval, pupa and adult) for avian and small

mammal species. All these factors will result in the increase in wildlife species, notably birds.

It is important that any changes in the distribution and species composition of fish and wildlife be documented. The documentation of such changes will help fulfill regulatory requirements and will also add to the scientific data base on the Muddy River. It will also allow later comparisons to be made between the various community groups (i.e., aquatic water quality, sediment quality, and wetland shoreline and upland habitat. Every 2 years a biologist should visit the site several times in the early and late growing seasons to document wildlife use of the habitat. Responsibility of this activity would be split by ratio of watershed area.

6.9.4 Monitoring and Maintenance of Historic and Character Defining Features

One of the requirements for Phase I of the Muddy River Flood Control, Water Quality and Habitat Enhancement, and Historic Restoration Project, is that the Proponents will be required to maintain the historic and character defining features of the restored parks. In order to fulfill this requirement, it will be necessary for Boston and Brookline to develop a report on annual site inspections to assess the condition of these features and to reevaluate and adjust maintenance efforts as required.

The historic and character defining features include what the National Park Service guidelines call the character defining features, which under the National Park Service (NPS) guidelines would include:

- Spatial relationships;
- Views and vistas;
- Topography;
- Circulation systems and site entries;
- Vegetation;
- Water features; and
- Furnishings and structures.

The Master Plan for the Emerald Necklace Parks, Jamaica Pond, Olmsted Park, The Riverway, and the Back Bay Fens provides an invaluable resource for the stewards of the Emerald Necklace. The recommendations set forth in the document are intended to provide a framework for decision-making and to lay the groundwork for preserving, rehabilitating and restoring these features.

The work proposed in the EIR will provide historical restoration, rehabilitation or preservation of the existing character defining features. The monitoring of structural integrity and conditions of historical features should be an ongoing process.

Scheduling of rehabilitation or repair work for each of these historic features should be included in the annual budget as an estimated contingency item. Immediate issues should be reported by staff and if they are life threatening they should be repaired or stabilized immediately.

Monitoring and recording of the integrity of spatial relationships of features and the important views and vistas created by Olmsted's plant massings, topography and circulation system will ensure the continuation of their integrity into the future. This should be done in the fall and should be scheduled for winter or next spring's work. While not strictly an issue of historic and character defining features, monitoring the condition of the furnishings and structures including lighting, benches, trash receptacles, etc. is critical and will insure the continuation of their integrity. This should be done in the spring of each year and should be scheduled for that spring's work. Monitoring the condition of all paved surfaces and circulation systems should be done on a yearly basis in the fall and repairs should be scheduled for the next spring or for winter work.

Vegetation monitoring is discussed previously in this section – Observations on the Growth of Shrubs, Wetlands and Other Habitat Plantings. This work should generally be monitored during the growing season and should be scheduled for work in the winter and in the next planting season.

Many of these features can be part of routine maintenance and can be projected each year based on past requirements. Some of this work, however, falls to specialized trades. For example the key trades involved in the management and maintenance of the bridges and buildings are masonry, carpentry, painting, lighting and plumbing, as well as, graffiti removal.

Inspection of these features should be scheduled on an annual basis. Immediate issues should be reported by the staff on a daily basis. Since specialized trades are required, these are not routine maintenance operations. The two exceptions should be graffiti removal, which should be removed immediately by parks personnel who are trained to remove it safely and vandalism, which also needs to be repaired immediately to reduce reoccurrence. Responsibility for this activity would rest with the park owner.

6.10 Maintenance Costs

The purpose of this section is to identify those costs that need to be provided to accomplish the Management and Maintenance Plan as outlined in this report section. Costs have been divided into the annual maintenance costs for the BMPs in this report and non BMP related maintenance costs. The BMP costs will not have to be provided until the BMP is actually constructed which may be after the main capital construction program. However, the estimated cost to support all BMPs is included in this section.

The increase in labor recommended to meet increased maintenance standards is likely to be met with a combination of increased efficiency, volunteer staff, contract staff and new staff. Not knowing the exact mix of how this enhanced staffing will ultimately be

met based on the results of management changes makes it difficult to estimate a dollar figure. For purposes of this report, we have taken the total future labor hours (in FTEs) and calculated a total maintenance value at an average labor rate of $30,000 per employee per year. A cost for equipment and supplies has been added since typically the labor is about 70 percent of total cost (from ETM). This total future maintenance value may be added in several ways. Part of these costs are already included in the respective budgets, certain of the costs are expected to be included in service contracts. Additional value will be gained through volunteers, better training, organization changes and some new staff.

6.10.1 Annual Cost of Maintenance for BMPs

Annual operation and maintenance costs of watershed BMPs and treatment control BMPs are included on Table 6-9. Some of the programs are on a watershed wide basis and we have estimated the cost to be centrally administered and shared by the agencies on a watershed ownership basis. Where the activity is listed as a Boston or Brookline responsibility, the actual agency conducting the work will vary. In Boston for example, Boston Water and Sewer Commission, Boston Public Works Department or BPRD may actually be conducting the maintenance item. The BPRD will be coordinating the work and making these assignments through the City of Boston. In Brookline, maintenance activities will be shared by the Parks and Open Space Division, Brookline Department of Public Works and the Water and Sewer Enterprise Fund.

A total of $271,800 in annual operation and maintenance costs have been identified for BMP related maintenance items. Of this total, $96,000 is for maintaining the sedimentation basins in the river formed by over dredging. Annual maintenance for overdredging was calculated by estimating the cost of annual measurement of dredging accumulation and then the cost of removing the accumulated dredge material on a periodic basis. While this is considered an annual cost to the project since it is an accumulation occurring each year, this item may be addressed as a capital project under some of the agencies budgeting regulations. This being the case the $96,000 may not be appropriated each year but on a periodic basis as the need for dredging arises.

The catch basin cleaning program has been estimated as part of this section, however most of these costs are currently being included under other departments' budgets. In Boston, the Boston Water and Sewer Commission is cleaning all catch basins as part of their identification and cleaning program. At the end of this program, they will be determining the most cost effective cleaning frequency and providing agency resources on an annual basis to meet the recommended program. In Brookline, the cost of the catch basin cleaning program is already being born by the Department of Public Works and the programs enhancements include targeting catch basins needing more frequent cleaning based on past removal rates. The MDC on the other hand needs to implement an improved management program. While they currently clean catch basins there will have to be an upgrade to keep these facilities operating to prevent sediment from reaching the Muddy River.

Table 6-9
Summary of O and M Costs for Watershed BMPs

Best Management Practice (BMP)	***Responsibility***	***Type of BMP***	***Boston***	***Brookline***	***MDC***	***Total O & M***
Basin-Wide Source Control BMPs						
Catch basin cleaning program*	Boston, Brookline, MDC	Non-structural	$25000[2]	$10,000	$6,500	$41,500
Improved street sweeping program	Boston, Brookline, MDC	Non-structural	$9000[3]			$9,000
Public education program	Administered centrally with shared cost	Non-structural	$1,500	$3,000	$500	$5,000
Waterfowl control program	Boston, Brookline, MDC	Non-structural	$1,000	$1,000		$2,000
Annual water quality sampling program	Administered centrally with shared cost	Non-structural	$19,000	$50,000	$6,000	$75,000
Catch basin labeling program	MDC	Non-structural	No new costs to conduct this program			
Review and strengthen park and stormwater regulations	Boston, Brookline	Non-structural	No new costs to conduct this program			
Back Bay Fens - Treatment Control BMPs						
Vegetated swale in Victory Garden	Boston	Structural	$1,500			$1,500
Sedimentation basins in river	Boston, Brookline, MDC	Structural	$19,000	$50,000	$6,000	$75,000

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Table 6-9
Summary of O and M Costs for Watershed BMPs

Best Management Practice (BMP)	Responsibility	Type of BMP	Boston	Brookline	MDC	Total O & M
Riverway - Treatment Control BMPs						
Sedimentation basins in river	Boston, Brookline, MDC	Structural	$2,000	$5,000	$1,000	$8,000
Leverett Pond - Treatment Control BMPs						
Sedimentation basins in river	Boston, Brookline, MDC	Structural	$2,000	$6,000	$1,000	$9,000
Willow Pond - Treatment Control BMPs						
Sedimentation basins in river	Boston, Brookline, MDC	Structural	$1,000	$3,000	$0	$4,000
Watershed Treatment Control BMPs						
Two sand filters	Brookline	Structural		$6,500		$6,500
One bioretention	Brookline	Structural		$3,000		$3,000
One dry swale	Brookline	Structural		$1,500		$1,500
6 Particle Separators	Brookline	Structural		$5,000		$5,000
4 Particle Separators	Boston	Structural	$3,800			$3,800
23 Particle Separators - undefined	Brookline			$22,000		$22,000
	Total O &M Annual Budget		$84,800	$166,000	$21,000	$271,800

*Catchbasin cleaning already included in operating budgets

[1] Unless noted, costs included under Boston Parks and Recreation Dept.

[2] Boston Water & Sewer Commission

[3] Boston Public Works Dept.

6.10.2 Annual Cost of Maintenance for Non BMP Items

Several non-BMP related maintenance items will require appropriations on an annual basis to meet the goals of the Management and Maintenance Plan. The infrastructure along the river will have to be maintained on an annual basis. In general terms we estimate the value of maintenance on these structures at about 0.5 percent of their capital value each year. This value has been applied to the new planned infrastructure as well as the existing infrastructure. In practice this cost can be borne in several ways. Annually the structures may require minor repairs such as painting, pointing of stonework or patching due to wear or damage. Small items can be accomplished under the operating budget. Certain organizations prefer to cover these costs as a capital cost for an improvement program every few years. As a result, many of the infrastructure annual maintenance costs do not have to be appropriated every year depending on how the governing body proposes to fund repairs.

A cost for an annual cleaning program in the river to remove debris and trash accumulated from storms has been estimated.

A series of reports including the Annual Update Report for MEPA have been estimated in the annual operation and maintenance section.

Costs for maintenance around Spring Pond for the threatened Stickleback has also been included as a separate item. Details of this maintenance are discussed in Section 9.

Total BMP related costs have been added to the non-BMP related maintenance costs in Table 6-10 to present a total annual operation and maintenance cost including the park maintenance. The project proponents agree that the level of maintenance described in Section 6 is appropriate. The proponents will seek to fund this level of maintenance, subject to appropriation and the availability of funds. The proponents have already begun to address some of the maintenance recommendations. In recent months, Boston and Brookline have begun a joint training program for maintenance crews at the Arnold Arboretum. Boston has created an historic parks unit with a director, project manager for the Parkman Fund and assistant project manager. This unit works closely with partners in both the public and private sectors, in cooperation with BPRD's General Superintendent of Horticulture and city arborists. The Department has also reconvened its woodlands committee at the staff level. In Brookline, a recent shift to zone management resulted in a crew whose zone includes Brookline's portion of the Emerald Necklace. Both Boston and Brookline remain committed to closing the maintenance gap identified in Section 6.

Table 6-10
Summary of O and M Costs

Annual Operation & Maintenance Item	*Boston*	*Brookline*	*MDC*	*Total O & M*
Non BMP Infrastructure Maintenance Items				
Fens Bridge Maintenance			$4,000	$4,000
Brookline Ave Culvert Maintenance	$29,000			$29,000
Riverway Culvert Maintenance			$18,000	$18,000
Annual open channel inspections and cleaning	$6,000	$3,000	$1,000	$10,000
Existing bridge structures upstream of Sears rotary	$42,000	$42,000		$84,000
Existing bridge structures downstream of Sears rotary	$14,000		$55,000	$69,000
Other Annual Operation & Maintenance Items				
MEPA Annual Update Report	$10,000	$27,000	$3,000	$40,000
Report on plantings	$2,000	$7,000	$1,000	$10,000
Report on Aquatic and Wildlife Distribution	$2,000	$6,000	$1,000	$9,000
Report on Historic / Character Defining Features	$1,000	$2,000		$3,000
Park maintenance activities (maintenance value)	$864,000	$249,000	$206,000	$1,319,000
Spring Pond Maintenance	$2,000	$0	$0	$2,000
Total Non BMP Operation and Maintenance Costs				
BMP Operation and Maintenance Costs (Table 6-8)				
Total Operation and Maintenance Costs				

*Total annual costs at end of two year maintenance of construction prog

7

Section Seven

Section 7
Historic Resources

7.1 Introduction

As described in the Draft EIR, one of the five goals of the Phase I project is historic preservation. The following actions were identified as necessary in achieving this goal:

- Remove invasive vegetation;
- Protect historic resources from damage due to construction;
- Preserve and rehabilitate the historic river bank configuration along the Muddy River, including restoration of the historic islands; and
- Plant vegetation in keeping with the historic landscape design, guided by the Emerald Necklace Master Plan.

7.2 MEPA Certificate and Draft EIR Comments

The MEPA Certificate on the Draft EIR had the following comments regarding historic resources:

- Consult with the Massachusetts Historical Commission (MHC) on methods of avoiding, minimizing, or mitigating impacts. Also consult with MHC regarding alternatives under consideration for the Carlton Street Footbridge.
- Include more detail on measures to protect historic and cultural resources within the project area during construction and beyond, including protection of plantings, structures and other historic landscape features.
- The Carlton Street Footbridge is historically significant. Brookline must act in good faith to expeditiously implement the elements of the Master Plan within its control, including the rehabilitation and reopening of the footbridge.
- Any change in Brookline's commitment to rehabilitate and reopen the footbridge will require, at a minimum, the filing of a Notice of Project Change.

MHC submitted comments requesting more detailed plans, drawings, and technical information concerning the aeration process (due to concerns over the possible adverse effect of the cascade aeration structures and large culverts); stone arch culverts; culvert enlargements; and the Carlton Street Footbridge.

MHC also suggests that the ACOE, Boston Landmarks Commission, and Brookline Preservation Commission meet to discuss the project to facilitate identifying consulting parties and to involve the public in the Section 106 process.

Other comments on the Draft EIR include concerns over the preservation of heritage trees; rehabilitation of arches, headwalls, and channel alignment; and the need for more detail on landscape preservation and mitigation measures.

7.3 Historical Treatments and Measures to Protect Existing Historic and Cultural Resources

7.3.1 Historical Treatments

MHC and other parties will be provided with more detailed information and plans showing the historical treatment of new and rehabilitated structures. Aeration structures, which were mentioned by MHC as a concern, are not proposed as part of the preferred project. The intention of the culvert headwall design is to provide stone facing on an arched culvert design in keeping with other historic structures on the river.

For the new Riverway and Brookline Avenue culverts, headwalls will be constructed of cast-in-place concrete on concrete foundations. In areas where there are multiple culvert inlets and outlets (i.e., upstream and downstream ends of Riverway and downstream end of Brookline Avenue if the existing 7′ x 9′ culvert is retained), the headwalls will be constructed to integrate all of the openings into one singular headwall. The headwalls will be faced with asher stone at a slight slant to match the other culverts headwall exterior facings along the river.

For the culvert at Avenue Louis Pasteur, the downstream headwall will be restored using the existing pudding stone as the facing for the headwall. A new concrete headwall will be constructed of cast-in-place concrete on a concrete footing and the existing pudding stone will be reused as the facing material. Prior to restoration, the existing pudding stone will be removed by hand along with all of the existing vegetation that has grown through the stones. The upstream headwall will be reconstructed using the pudding stone that currently serves as a decorative wall on the upstream of the culvert. In addition, it is believed that additional pudding stone was buried on the upstream side of the culvert. The upstream side will therefore be excavated in a manner to save and reuse any additional pudding stone that may exist. The upstream site will be constructed in the same manner as the downstream side.

7.3.2 Measures to Protect Existing Resources

As discussed in the Draft EIR, measures to protect existing resources will be put in place before construction begins and will remain in place for the duration of construction. These measures include:

- Enclosing historic features and vegetation with chain link fencing, as needed, including gated entries to the features to exclude construction activities;

- Protection fencing will remain in place until final completion of all proposed adjacent work;
- Entrance and egress to historic features will be signed to control, direct, and protect pedestrian and vehicular access;
- Bridges will include protection as needed in addition to limits placed on dredging in the specification so as not to disturb footing structures; and
- In locations where there will be larger expanses of shoreline that are not to be disturbed, the entire area will be separated from the construction area by fencing.

In addition to the above measures, heritage trees will be protected by chain link fencing (as needed) to their drip line, pruned, and fertilized so impact to them should be minimal. No heritage trees will be removed.

Further protection measures, beyond those described above, will be developed as necessary in consultation with MHC, the Boston Landmarks Commission, and the Brookline Preservation Commission during the final design and permitting process. In addition, these parties will be involved during the design of rehabilitated and new structures to ensure compatibility and consistency with the historic context of the Emerald Necklace. Plans will be forwarded when they are available (after the Final EIR is complete and design has advanced further).

7.3.3 Update on Carlton Street Footbridge

There were several comments on the plans for the Carlton Street Footbridge. As summarized in a September 6, 2002 letter from A. Thomas DeMaio, Commissioner of Public Works, to the CAC (see Appendix B), the footbridge was the subject of two Warrant Articles at the Brookline Town Meeting in spring of 2002. One article proposed its removal and the other proposed its rehabilitation. In response to those opposing articles, the Selectmen proposed a resolution that was adopted by simple majority after formal debate. In summary, Town Meeting requested that further cost and feasibility analyses be conducted regarding the future of the footbridge. The Engineering Division was further directed to examine the identified cost factors and present the results of the analyses in preparation for the 2003 Spring Town Meeting. Based on these results, the Selectmen will provide an article in the FY '04 Warrant that will appropriate an initial sum for preliminary plans to carry out the option selected at Town Meeting. A total of $600,000 has been allocated in the Town's Capital Improvement Plan for this purpose. It is anticipated that the Engineering Division will conduct the cost evaluations in their 2002-2003 fall/winter schedule.

A Notice of Project Change will be filed if the Town does not move forward with rehabilitation.

7.4 Origin and Preservation of The Emerald Necklace Parkways

The Emerald Necklace parkways including the Fenway, Park Drive, the Jamaica Way, Riverway, and Arborway which line the Emerald Necklace Parks are under care, custody and control of the Metropolitan District Commission. These historic parkways have been listed on the National Register of Historic Places and are intended for pleasure vehicles only. MDC regulations (350 CMR 4.01 sect. 10) limit use of these parkways, and other MDC-designated pleasure vehicle-only parkways, to vehicles with a capacity of 12 persons or less except by express written consent of the Commission. These parkways, which wind around the parks, are not designed for safe travel of larger vehicles and the intent of these regulations is to preserve the integrity of the historic nature of the parkways.

The modern origins of the "Park Way" concept, defined and developed by Frederick Law Olmsted in 1861 in New York provided a way to connect a city's park to the fabric of the community. Now a century later, some have forgotten the lessons of the parkway — their purpose and their contribution to a community's quality of life, public health and safety.

It is important to remember that our parkways are not "just roads." They are part of our park and open space and our historic landscape heritage. Whether it is along a river, such as the Muddy River, or through a park or to the summit of the highest mountains, parkways allow the walker, the biker, the hiker and the commuter passage through a place while providing a sense of being somewhere while en route to somewhere else. They provide a period of respite and a little breathing room during a busy day. But most importantly, they provide what Olmsted originally envisioned as "nature in the city," a small miracle in our age of hustle, bustle, stress, and confrontation.

After more than a century of use our parkways have deteriorated and suffered from deferred maintenance and inappropriate alterations. It has been clear that these valued transportation and open space resources are in need of a new strategy.

That is why, as part of the Commonwealth's continuing commitment to historic landscape preservation, and in direct response to the deterioration of historic parkroads and parkways, the Historic Parkways Initiative was launched in October 2002 by Environmental Affairs Secretary Bob Durand. The Historic Parkways Initiative -- a coalition of the Executive Office of Environmental Affairs, the Department of Environmental Management, the Metropolitan District Commission, and other public and private organizations -- works to protect, preserve, and enhance historic parkways throughout the Commonwealth. Through advocacy, education, and action, and in the spirit of partnership, the Initiative celebrates the invaluable scenic, cultural, recreational, and transportation roles of these remarkable and diverse parkways. A catalyst for change, the Initiative is building new models of stewardship and revitalization for these treasured resources.

8

Section Eight

Section 8

Section 8
Back Bay Yard

8.1 Introduction

An area adjacent to the Massachusetts Bay Transit Authority (MBTA) Green Line tracks and the Boston Parks Department Back Bay Yard has been heavily used for mountain/dirt bike activities. The area of dirt bike activity, shown on Figure 8-1, is approximately 7,800 square feet in size. It is located adjacent to the Boston Parks and Recreation Department facility known as the "Back Bay Yard." The disturbed area is on the west side (railroad side) of the berm that separates the Riverway Park from the MBTA tracks. This dirt bike area is contained within a larger area of an approximately 50,000 square foot (about 1.1 acres) parcel on Park Drive.

8.2 MEPA Certificate and Draft EIR Comments

The MEPA Certificate on the Draft EIR states that the mountain/dirt bike areas near the Back Bay Yard could be a "locally significant source of sediment" and notes that ownership is unclear. The Secretary states that the Final EIR should include a determination of the property owner, and if the City of Boston owns the property, should include appropriate plans to restore the landscape of the area. If the MBTA owns the site, the Secretary requests that the Muddy River project proponents work with the MBTA to ensure its rehabilitation.

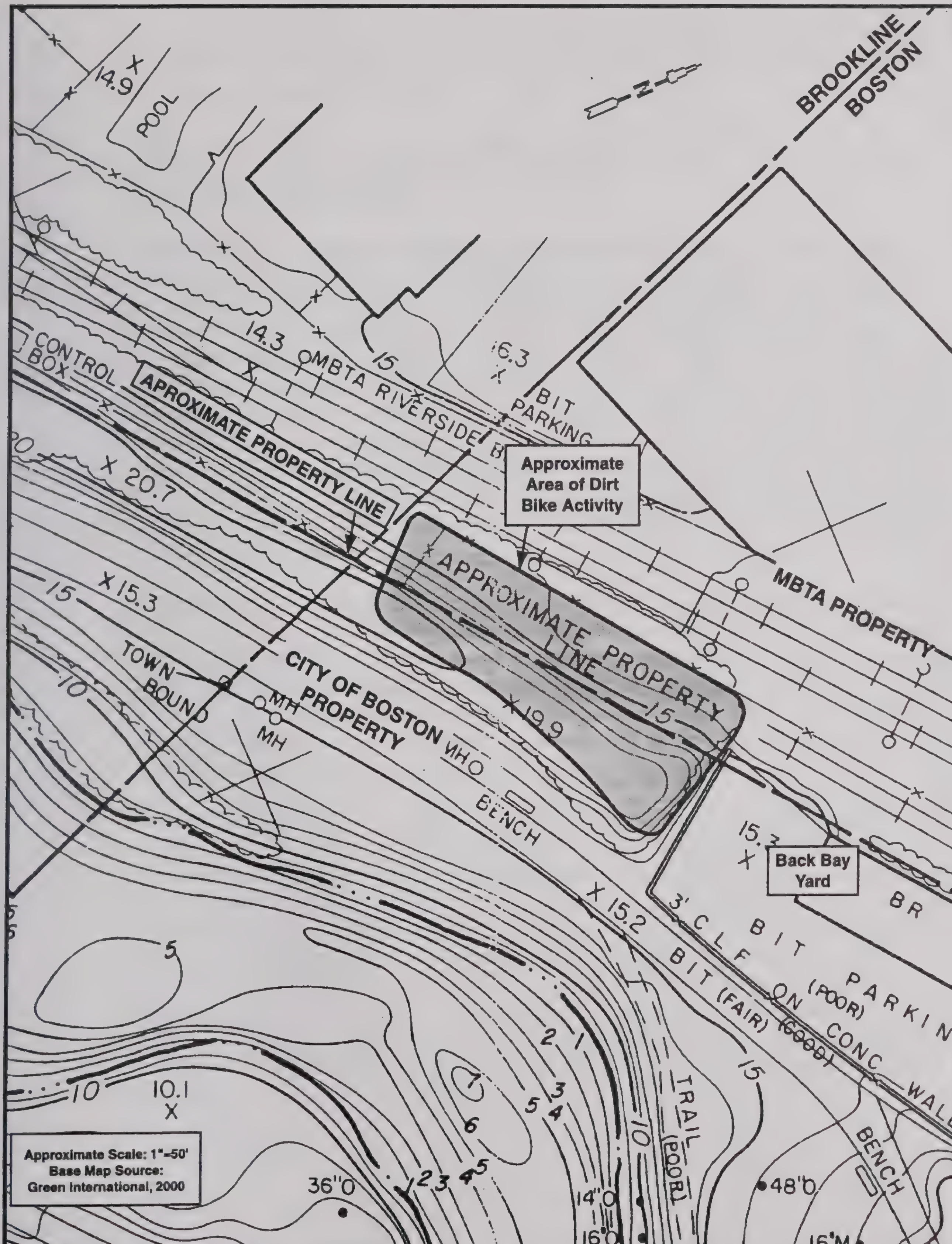
8.3 Ownership and Restoration

Land ownership was researched by Parsons Brinckerhoff as described below.

From the Suffolk County Registry of Deeds, a copy of a plan was obtained showing the 49,553 square feet of land transferred from Amos A. Lawrence to the City of Boston on September 13, 1883 for the purpose of the creation of the park now known as the Riverway. This parcel of land includes the present location of Back Bay Yard. The plan of this parcel shows the property line of the railroad, then known as the "Brookline Branch Railroad" and now known as the MBTA's Riverside Branch (Highland Branch) of the Green Line.

Copies of the Survey Plans and Profiles of the Metropolitan Transit Authority (MTA) Highland Branch in the vicinity of Park Drive (dated May 27, 1958) were obtained from MBTA. The plans show the land transferred from the Boston & Albany Railroad (Successor to the Brookline Branch Railroad) to the MTA (predecessor of the MBTA).

A copy of a plan of the land in the vicinity of Back Bay Yard was obtained from the Boston Parks and Recreation Department. This plan shows a straight property line between the park and the railroad property.



CDM

Figure 8-1
Back Bay Yard Dirt Bike Area

Together, these plans consistently show the property line of the railroad as a straight line parallel to the backside of the building at Back Bay Yard and following the fence lines in a straight line from Park Drive south.

Based on record plans and site investigations, access to the dirt bike trail area is possible only because most of the fence along the property line has been removed in the area of the dirt bike trails.

The 2000 survey by Green International shows that the existing fence line along the railroad angles closer to the current tracks approaching Park Drive from the south. At the south end of Back Bay Yard, the fence line turns eastward. This existing fence line is closer to the tracks than the original fence line shown on the 1958 MTA plans. Remnants of the original fence line were found along the property line and within the bike trail area during site investigations, reflecting the change in use of this area. The rails in the dirt bike area are the remains of a spur track that was abandoned in the late 1970s. Since that time, MBTA has maintained the fence closest to its operating transit track (current Green Line), while the old fence along the property line has fallen into disrepair and portions of the old fence in the vicinity of the dirt bike paths have been removed. The conclusion is that most of the dirt bike area is on the MBTA side of the property line.

Research was conducted to determine if ownership of this small area was transferred from the MBTA to the Parks Department. However, there is no indication that the dirt bike trail area on MBTA property was ever transferred from the railroad to the Parks Department. In researching the ownership of the park, the Parks Department's file on the Riverway, including all property acquisitions and sales, was reviewed. No item in this file was found that would indicate a transfer of land from the railroad to the Parks Department in the area where the dirt bike paths are located.

The conclusion is that the area of the dirt bike trails is on both the MBTA property and Boston Parks Department property based on a site visit by CDM. In addition, sediment from this area would not typically reach the Muddy River, as it is separated from the river by a berm. Therefore, the trail area is not a "locally significant source of sediment" as suggested in the MEPA Certificate. Because the dirt bike activities do not threaten river water quality and the proponents and CAC understand the recreational benefit the area provides, the City of Boston currently has no plans to restore the area. The area will be monitored to be sure that it does not impact parkland on the river side of the berm. If the area of disturbance expands to the river side of the berm, measures will be taken to stabilize the disturbed area within park property.

9

Section Nine

Section 9
Rare Species

9.1 Introduction

The only verifiable rare species identified in the project area is the state-listed threatened Threespine Stickleback (*Gasterosteus aculeatus*) (Figure 9-1). This unique fish species is found in Spring Pond (the only remaining one of Olmsted's natural history pools), its outlet stream, and a small area at the inlet of Willow Pond from Spring Pond. In Massachusetts, Threespine Sticklebacks are found along the coast in estuaries, salt marshes, and tidal creeks. The only known trimorphic, landlocked population in Massachusetts is that in Olmsted Park. It is possible that this population was introduced by members of the Boston Society of Natural History as part of a never-completed natural history museum complex proposed by Fredrick Law Olmsted. Due to their limited range in the urban park habitat, these fish are susceptible to extirpation (Hartel, Halliwell and Launer (Inland Fishes of Massachusetts, Mass. Audubon Society, 2002, pp 223-225). It is anticipated that the habitat improvements and restoration by this project will enhance the ultimate survivability of the Threespine Stickleback population in the Emerald Necklace.

A state endangered bird species, the Pied-billed Grebe (*Podilymbus podiceps*), has been observed in the area. However, because of the lack of suitable habitat, it is likely that the Pied-billed Grebe is only an occasional visitor to the Emerald Necklace. It has been concluded by the Massachusetts Natural Heritage & Endangered Species Program (MNHESP) that the Pied-billed Grebe will not be negatively impacted by the proposed project.

Comments on rare species received in response to the Draft EIR are summarized in this section and a discussion of permitting requirements follows. Plans for protection of rare species during construction are presented.

9.2 MEPA Certificate and Draft EIR Comments

Comment letters on the rare species habitat sections of the Draft EIR have been received from the public and referenced in the MEPA Certificate on the Draft EIR (see Appendix A). These comments are addressed in this Final EIR.

The MEPA Certificate requests that sufficient additional detail using MNHESP informational requirements (see Section 9.11) to allow MEPA review to determine whether impacts on rare and endangered species would be permittable under the Wetlands Protection Act at the local level or whether a DEP variance will be required. MEPA requests that the Final EIR demonstrate how the project can meet the DEP requirements for a variance, should this be required (see Section 9.11).

The Medical Academic and Scientific Community Organization (MASCO) comments that additional wildlife has been observed in the Riverway; specifically, red tailed hawks, peregrine falcons, hooded mergansers, and a great blue heron. Similarly, the Friends of the Muddy River note that the list of birds is incomplete without indicating

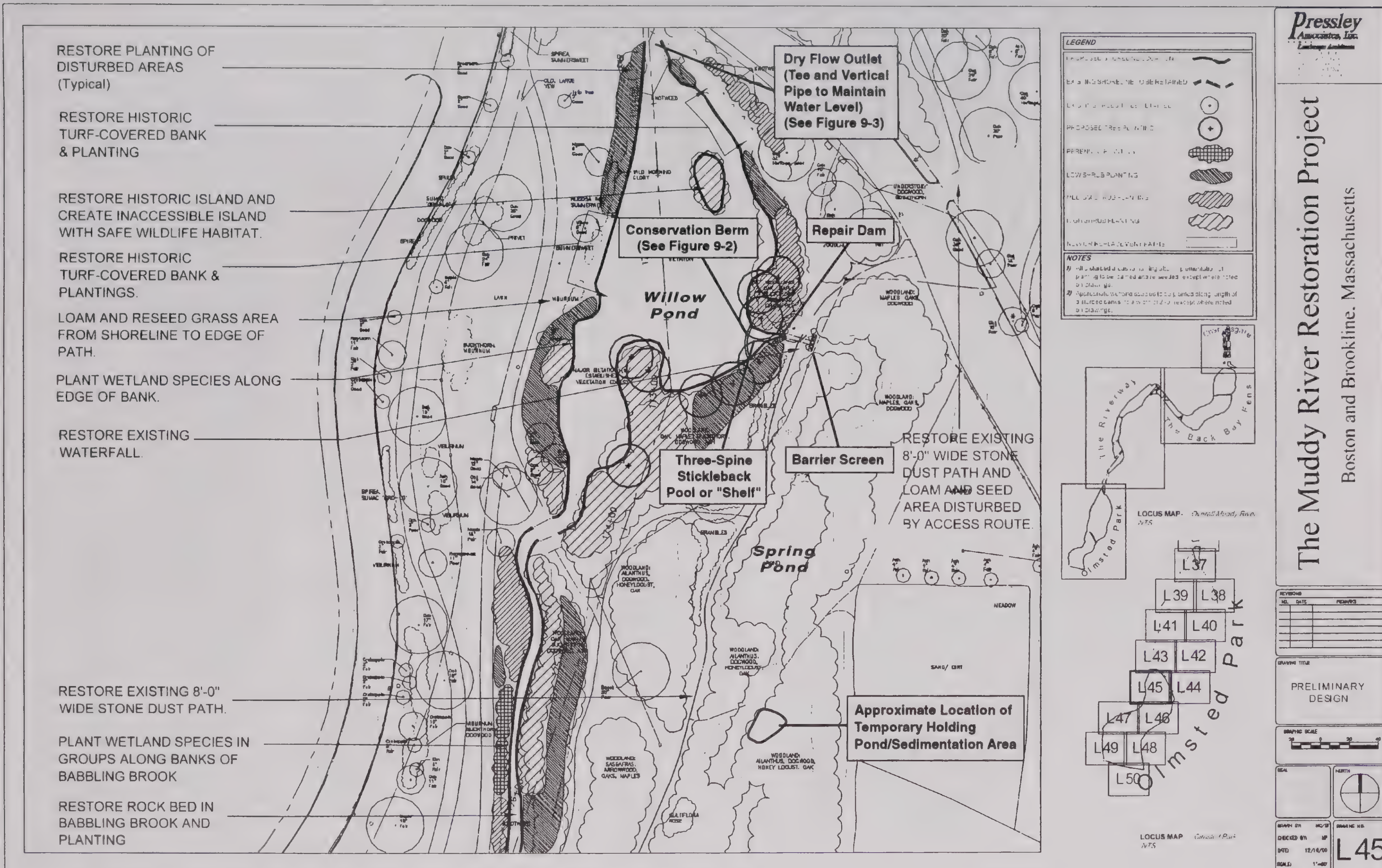


Figure 9-1
Project Location

CDM

the specific species they may have observed. The listing of wildlife in the Draft EIR was based upon field survey and was not intended to be inclusive of all species that may visit the area at any one time. Those identified are representative of birds that will frequent this habitat. Except as noted in Section 9.1, there are no threatened, endangered or rare species of birds in the Emerald Necklace.

Comments from the Charles River Watershed Association (CRWA) request more detail on mitigation measures. A mitigation plan to protect the Threespine Stickleback is detailed in this Final EIR (see Sections 9.5, 9.6 and 9.7).

The CRWA also asks for information on sediment conditions, its impact on and suitability for, spawning habitat of the Blueback Herring (*Alosa aestivaus*). The environmental enhancements to the Muddy River (i.e. dredging, BMPs, shoreline stabilization) are also anticipated to result in the migration of greater numbers of the blueback herring to Leverett Pond. The Blueback Herring is an anadromous fish that migrates to fresh water to spawn. To protect the species during spawning, there will be no dredging between March 1 and June 15 of any year. Eggs of the Blueback Herring sink and stick to anything they contact. Good sediment quality is very important for the survival of the eggs. Toxic or highly organic sediments are not as suitable as are relatively clean granular (sandy) bottoms. The young fry return to salt water within several months of hatching.

9.3 Natural History of the Threatened Threespine Stickleback

The Stickleback Family (*Gasterosteidae*) has been observed throughout the Northeast in marine, brackish and inland fresh waters. Typically, fish within this Family are small, seldom larger than three inches, with a maximum of four inches, total length (TL).

The *Gasterosteidae* are easily distinguished from other fish by the presence of dorsal (back) spines, which number two, three, four, seven or more, depending upon the particular genus. Some of these variants have bony plates in their scaleless skin, while others lack these plates altogether. The relative “strength” of this dermal armature appears to be dependent upon the ecology of their habitat, strong in saline and weak in fresh water.

A trimorphic freshwater population of Threespine Sticklebacks (*Gasterosteus aculeatus*) is listed as a State Threatened Species by the Massachusetts Natural Heritage & Endangered Species Program.

The Threespine Sticklebacks, like those in Olmsted Park, exist on a varied diet of small aquatic invertebrates (copepods, isopods), fish eggs, fish larvae, mollusks and aquatic plants. Sticklebacks are not only omnivorous but voracious (Bigelow and Schroeder, Fishes of the Gulf of Maine, DOI, Fish and Wildlife Service, 1953, pp 307-331).

The male Threespine Stickleback is normally somewhat drab in color ranging from deep gray, or olive, on the bottom and green-brown dorsally. The male’s sides are

silvery and reflective. As spawning draws near, the male's appearance darkens, developing a reddish color from the nose to the vent and often up the sides. The eyes turn a vivid shade of light blue. During spawning, the female Stickleback also turns reddish with a brownish back which exhibits transverse bands. The female's sides take on a brassy reflectiveness not seen the rest of the year.

Concurrent with the color changes, a distinct breeding behavior pattern is initiated by the male. He undertakes the building of small, barrel-shaped nests, in a sheltered locale in shallow water (i.e. the shallow shelf at the inlet of Willow Pond where the waters of Spring Pond inflow). The nest is typically constructed of pieces of grass, aquatic weeds and other vegetation, cemented together with mucous filaments and weighted down with pebbles. The males compete with each other in luring the females to the nest by a showy zigzag courtship display. One, or a succession of females, deposit up to 150 eggs per nest, which may contain up to 600 eggs overall. The male then enters the nest to fertilize the eggs, which stick in a clump to each other and to the nest itself (Bigelow and Schroeder, 1953).

Incubation occurs within a six to ten day duration. During this period, the male Stickleback guards the nest driving away any and all intruders. As the hatching time approaches, the male tears down the nest but continues to guard the fry until they absorb their yolk sacs and become independent. While the young fry are only 4.25 or 4.5 mm in length when hatched, they begin to take on adult characteristics and form, with developed fins and spines when they are six weeks in age.

The life span of the Threespine Stickleback varies between populations and habitat. Some live for only one year, others up to three-and-one-half (3.5) years. Many adult males die shortly after spawning.

Karsten E. Hartel, Curator Associate in Ichthyology at the Museum of Comparative Zoology at Harvard University, believes that two unique populations, or morphs, are present in Spring and Willow Ponds. Aside from the variation in distinct lateral plates, individual morphs represent only the fourth record of low plate individuals in eastern North America and the southern most completely freshwater (landlocked) observation. Further, it is possible that this population was introduced into the "natural history pools" by Olmsted as part of a natural history museum complex he and the Boston Society of Natural History had planned, but never fully realized. Spring Pond is the only remaining evidence that Olmsted's plans for a series of natural history pools was at least partially realized.

Hartel has found that the fish in the Willow Pond population are larger (possibly a different morph) than the Spring Pond population. This may or may not be due to larger foraging and nesting areas with abundant food supply and greater space in Willow Pond. The Threespine Sticklebacks in Spring Pond grow only to about one-and-one-half (1.5 in TL) inches while those adults collected from the inlet of Willow Pond appear to grow to two-and-one-half (2.5 in TL) inches in length. This condition may be due to how fish respond to their aquatic environment, which is dependent upon the aerial extent and suitability of their habitat. The larger size of individuals of

one population as compared to the other may be the result of long-term adaptation to the differing habitat conditions found in each pond.

Because two sub-populations or morphs have evolved, a separate temporary holding pool will be used during construction, as described later in this section, rather than relocation of the individuals from Willow Pond up into Spring Pond during construction as originally proposed in the Draft EIR. A separate temporary pool will keep the two populations separate.

9.4 Data from Previous Surveys

The results of the survey for the Threespine Stickleback that was conducted as part of the Draft EIR are provided in Section 4.6.2.3 of that document.

The Threespine Stickleback was found in Spring Pond as well as in a small pool that is immediately below the small dam between Spring Pond and Willow Pond. The fish in Spring Pond and the pool were observed visually and later confirmed by electro-shocking. The electro-shocking was conducted as a survey for representative fish along the various segments of the entire Muddy River Project area. Although electro-shocking temporarily stuns the fish and usually allows the fish to return to a conscious state, it can kill individuals that are subjected to too much current for their condition. The fish surveys along the Muddy River were not intended to generate population-specific data, only to establish which species were present. Rather than risk harming Sticklebacks, there is no need to conduct any electro-shocking in the future as long as other collection techniques (i.e. seining or minnow traps) are available.

9.5 Overview of the Proposed Environmental Enhancement Work at Spring and Willow Ponds

The Threespine Stickleback inhabits Spring Pond which is a small tributary to Willow Pond. Spring Pond flows into a small brook (approximately 150 feet long) that passes under a pathway and enters Willow Pond. A one and one-half to two foot high stone spillway that is in need of repair, separates the brook from Spring Pond from Willow Pond. Spring Pond is kept considerably cooler than Willow Pond by the discharge of groundwater into the Spring Pond.

During the preparation of the Draft EIR, the proposed project elements at Willow Pond were discussed with the MNHESP staff and reviewed in the field. Through these and other efforts, opportunities were observed where the habitat conditions for the Threespine Stickleback can be protected, as well as possibly, enhanced.

The MNHESP, the DEP, Boston Conservation Commission, and others requested that the details of a habitat protection, mitigation and enhancement effort be provided. The protection, mitigation, and enhancement effort will be conducted for the proponents by a qualified fisheries biologist. This includes:

- The capture of Threespine Sticklebacks that are inhabiting the inlet to Willow Pond below the Spring Pond dam and relocating them to a temporary holding pool

(constructed 12 months in advance). See Sections 9.6 through 9.8 for more information;

- The restoration of the historic Willow Pond capacity by the dredging and removal of approximately 5,900 cubic yards (cy) of accumulated and contaminated sediment;
- The removal of invasive vegetation around Willow Pond;
- The rehabilitation of the stone spillway between Willow Pond and the brook leading from Spring Pond;
- Preservation of the shelf habitat of the Threespine Stickleback in Willow Pond;
- Addition of a small gravel berm at the edge of the shelf habitat to define the outer edge of the Stickleback pool in Willow Pond and to serve as a barrier to predation;
- Repair and modification of the water level controlling discharge pipe in Willow Pond;
- The control of sediments and nutrients entering Spring Pond from the adjacent bank and pathways;
- The creation of the small pool or forebay above Spring Pond, including water cress and shade plantings, for Sticklebacks which are temporarily relocated from Willow Pond;
- The preservation of the historic park features at Willow Pond by the revegetation of the new bank, the reintroduction of an island in Willow Pond, and the establishment of wetland areas and the restoration of terrestrial habitat with indigenous plantings;
- The repair or replacement of worn pathways and denuded ground.

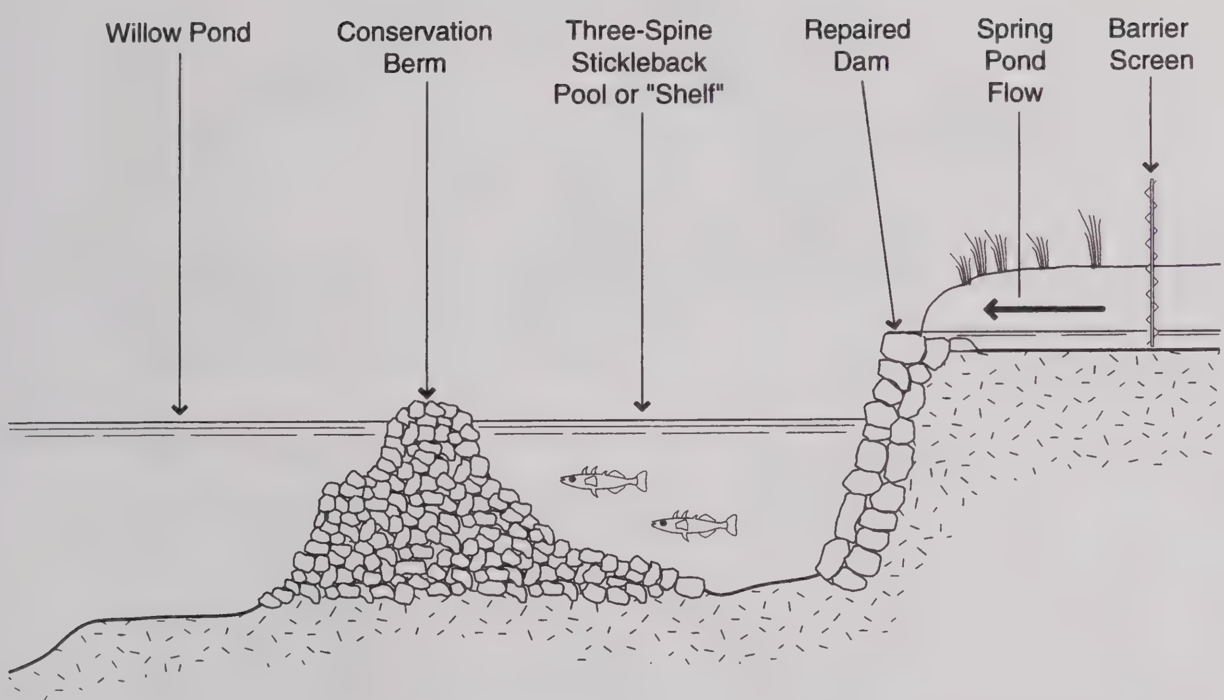
The relative locations of each of these tasks are shown on Figures 9-2 and 9-3. Project objectives met by the above construction activities are summarized on Table 9-1. Four of the activities address three or more of the project objectives.

9.6 Details of Environmental Enhancement and Mitigation

Details of the environmental mitigation work are as follows:

1. Invasive vegetation at Willow Pond will be removed from the buffer zone and other contiguous areas under the direction of the landscape architect.

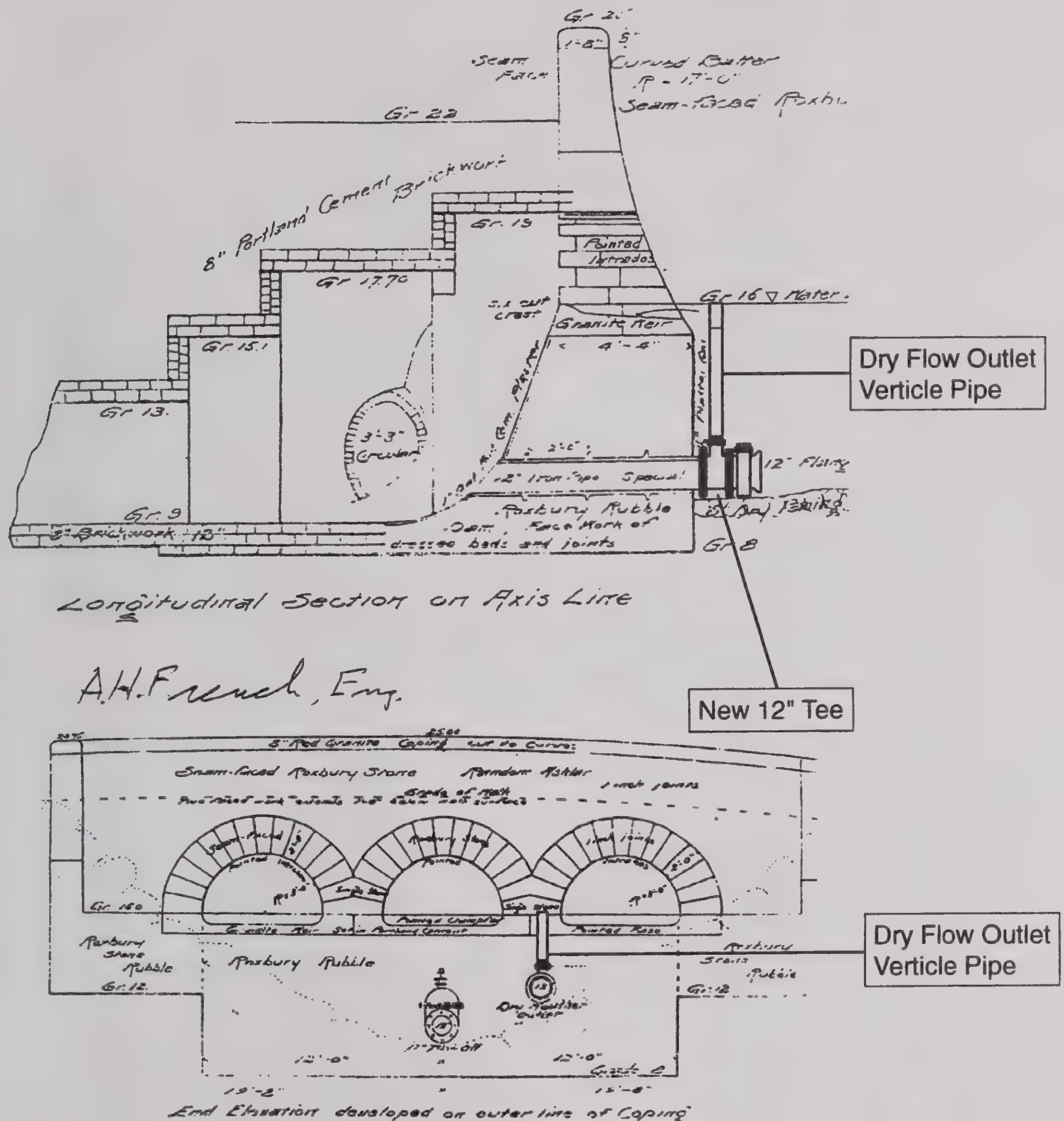
2. The repair of eroded banks along the former MDC skating rink will be accomplished. There are a number of locations along the former MDC Kelly Rink where paths cut across from the rink area and down the steep



Threespine Stickleback
Gasterosteus aculeatus Linnaeus 1758

(Source: Hartel, et.al.)

Figure 9-2
Proposed Mitigation at Willow Pond
Habitat Enhancement



Not to Scale

Figure 9-3
Proposed Dry Flow Outlet at Willow Pond

TABLE 9-1
PROJECT OBJECTIVES MET BY WILLOW POND PROJECT ELEMENTS

	PROVIDE FLOOD CONTROL	*IMPROVE WATER QUALITY*	*ENHANCE AQUATIC & RIPARIAN HABITAT*	*REHABILITATE LANDSCAPE & HISTORIC RESOURCES*	*INSTITUTE BEST MANAGEMENT PRACTICES*
Dredge approximately 5,900 CY of sediment	None	Removing sediments will improve water quality in pond	Removing sediments will improve bottom habitat and improve water quality	Restores historic capacity and shape of pond	None
Re-vegetate disturbed bank areas and establish wetland areas	None	Reduces erosion from unvegetated areas	Results in more diverse aquatic and riparian habitat	Rehabilitates landscape treatment from Olmsted plant list	Reduces erosion from unvegetated areas
Rehabilitate historic island	None	None	Results in more diverse aquatic and riparian habitat	Rehabilitates historic feature of Olmsted park	None
Enhancement of three spine stickleback habitat and rock dam outlet of Spring Pond		Slightly improves water quality in Babbling Brook tributary	Results in improved aquatic habitat for three spine stickleback	Restores one of the historic pool areas in Olmsted Park	None
Repair / replace pathways and re-vegetate desire lines and unplanted areas	None	Reduces erosion from unvegetated areas	Results in more diverse aquatic and riparian habitat	Rehabilitates landscape treatment from Olmsted plant list	Reduces erosion from unvegetated areas

embankment. There are also some random pathways (desire lines) through the trees in this area. This has caused erosion directly into Spring Pond. To control this there are several tasks that need to be accomplished:

- The eroded pathways will be stabilized with vegetation and stone dust to mitigate erosion and transport of sediment to Spring Pond.
- At the upper end of Spring Pond there is an accumulation of sand/gravel (see Figure 9-1) that has been scoured from the adjacent wetland by high energy storm flow from a surcharged BWSC manhole at Brynner Street. During preparation of the Draft EIR this matter was called to the attention of the BWSC, and they responded by cleaning the main drainage line from the area adjacent to Brynner Street and toward the Daisy field outlet to Leverett Pond. According to BWSC, this should have eliminated all flows from discharging into Spring Pond.

3. In relation to the problems that have been caused by runoff discharging into the wetland and flowing into Spring Pond, the following needs to be accomplished:

   - The wetland upstream of Spring Pond will be cleaned of trash and debris by hand.
   - A shallow settling area will be excavated adjacent to the wetland upstream of Spring Pond where scouring has already damaged the habitat. However, the settling area is not intended to be contiguous with Spring Pond. It will be located approximately 5.5 feet south of the pond. An area of coarse stone will surround and separate the settling area and the wetlands. Whereas this basin will constructed off-line, the intermittent stream will need to be redirected through this basin. During construction of the settling area, Spring Pond water quality will be protected by specific soil and erosion control procedures.

4. Revegetation will occur in damaged areas as well as at locations where the buffer zone habitat needs enhancing around Willow Pond. This includes the planting of thick stands of bushes and shade trees. Revegetation of the buffer zone will be conducted in accordance with the Pressley Associates plans (see Figure 9-2). The planting plan includes dense areas of vegetation to discourage human and animal intrusion as well as an Olmsted "beach" on the Brookline side. The restored island will be densely revegetated.

5. Nutrient loading in Spring and Willow Ponds may originate from several sources such as: road run-off, fertilizers, and waterfowl and dog excrement. Restoration of the banks will reduce runoff to the ponds. The BPRD will refrain from using fertilizers or herbicides in the area adjacent to the ponds, signage will be located to discourage feeding of waterfowl (Canadian Geese and ducks), and use of pooper-scoopers by dog walkers will be encouraged.

9.7 Plan for Protection of Rare Species during Construction

It was originally proposed to relocate the Willow Pond Stickleback population to Spring Pond to avoid impacts to that population during dredging operations. Dr. Hartel recommended against this original plan. This is due to a concern that co-mingling the two different populations may have a negative impact due to foraging and territorial competition in the smaller pool as well as unknown interbreeding impacts between the two populations. Furthermore, relocation of individual populations is discouraged by DWW Policy 90-2 to the Wetlands Protection Act.

An alternative plan is proposed that provides for capture of the Willow Pond Sticklebacks as previously proposed, placing them in a new, temporary holding pool (the site of the planned settling area upstream of Spring Pond) until dredging operations in Willow Pond have been completed, and then returning the fish to their original habitat in Willow Pond. Under this alternative there is no adverse impact to the Spring Pond Sticklebacks, and minimal impact to the Willow Pond population.

It is proposed that the temporary holding pool be created by excavation of an area upstream of Spring Pond in the location of the settling area. Sizing the holding pool will be determined during the design period. This holding pool will have a sand bottom. Bordering vegetation will be planted, leaves and sticks can be placed in the pool to provide sheltering and "nesting"conditions for the Threespine Stickleback. Source water for the pool will be from the same spring system that supplies Spring Pond. It is believed that the cool spring water is what has sustained the Stickleback population in the Spring and Willow Ponds. This holding pool will be protected from upstream siltation by hay bales and silt screens, as appropriate. This pool will be created after the WPA permit approval is granted to allow time (about one year) for water quality stabilization and the establishment of a benthic and small invertebrate population prior to introduction of the Sticklebacks.

Upon completion of construction in Willow Pond, the Sticklebacks will be returned to their original habitat and the temporary pool will be allowed to remain, serving as a settling area to Spring Pond for long-term protection of Spring Pond from upstream siltation.

9.8 Survey and Capture Protocols

The goal of this work is to conduct the necessary improvements to the environmental features in and around Willow Pond with no, or at best minimal, disturbance to the threatened species.

To implement that portion of the mitigation plan that pertains directly to the Stickleback, the following protocol for capturing and temporarily relocating the Threespine Sticklebacks will be required in the order in which the item is listed:

1. Place a V-notch weir as close to the outlet from Spring Pond and its dam as possible (see Figure 9-2). The invert of the V-notch should be no lower than

the present water elevation. This will prevent the unnecessary loss of water from Spring Pond and the lowering of the shallow water depth of Spring Pond. There cannot be any lowering of Spring Pond because the water body is already very shallow with years of accumulated sediment and leaves and debris.

2. Immediately upstream of the V-notch weir, install two screens across the outlet (see Figure 9-2). Their purpose is to keep Sticklebacks from swimming out of Spring Pond and into the construction area. One screen will consist of one-inch mesh and the second screen, closest to the weir, will be 0.25-inch mesh. These screens must be maintained during construction because algae and leaves, etc., will accumulate behind them leading to clogging. The screens will be removed after construction activities are complete.

3. Using seines, nets and/or minnow traps, the Sticklebacks in the small embayment in Willow Pond will be captured and moved to the temporary holding pool above Spring Pond. Once the fish are netted they will be placed in a five-gallon bucket of water from Spring Pond. Without delay the captured fish will be moved to the pool above Spring Pond and released.

4. Once it is determined that most, if not all, Sticklebacks have been captured and moved to the pool, the capture and related efforts will conclude and the reconstruction of the Spring Pond Dam and dredging of Willow Pond can commence.

5. The repairs to the Spring Pond dam include the replacement of stone that have fallen from the dam spillway and face.

9.9 Project Timing

The timing and duration of the project elements will be determined by funding availability and environmental constraints such as spawning period. However, it is currently anticipated that project final design will occur during 2003 and that construction activities will take place subsequently.

Actions to protect the Threespine Stickleback and its habitat will necessarily be scheduled prior to any dredging or related construction activities in Willow Pond. Capture of Threespine Stickleback in Willow Pond for temporary holding prior to return to their original habitat in Willow Pond will be scheduled around (to avoid) the Threespine Stickleback spawning period, May to July. The consultant fisheries biologist together with the Independent Environmental Monitor will determine whether or not nest building has commenced.

9.10 Environmental Monitoring and Maintenance

Project management and maintenance is addressed in Section 6 of this Final EIR. That plan provides for quarterly water quality sampling to be collected during a dry period (no rainfall in the past 96 hours), during precipitation, and the day following a precipitation event. The rationale behind this frequency of sampling is to obtain

seasonal data preceding precipitation (rain or snow), and to monitor the impact to water quality during and after an event. Therefore, in any given year, up to 12 sampling events will occur at each sampling location.

During each quarter, water quality samples will include:

Sample Parameters	
Fecal Coliform Bacteria	Turbidity
Fecal Streptococcus Coliform Bacteria	Alkalinity
Total Suspended Solids (TSS)	Acidity
True and Apparent Color	Ammonia Nitrogen
Total Phosphorus	Nitrate-Nitrite Nitrogen
Orthophosphate Phosphorus	Metals
pH	TPH-EPH
Temperature	
Dissolved Oxygen	

During the one year stabilization and "acclimatization" period and the subsequent temporary "holding" period prior to relocation of the Willow Pond fish, the Threespine Stickleback holding pool located upstream of Spring Pond will also be sampled quarterly. Physical inspection of the holding pool during the acclimatization period will be monthly by the consulting fisheries biologist and reported to the Independent Environmental Monitor.

In the Threespine Stickleback habitat areas in Willow Pond, Spring Pond and the temporary holding pool (the eventual Spring Pond sediment control settling area), a special plan is required to monitor and maintain the viability of the fish during the construction period. The Independent Environmental Monitor will be specified to undertake:

1. Review monthly reporting of the consulting fisheries biologist during stabilization and acclimatization of the holding pool, inspect the pool for development as a suitable Stickleback habitat in respect to food supply, shelter, substrate and water quality.

2. Oversee the capture and transfer of Willow Pond Sticklebacks to the temporary holding pool.

3. On a biweekly basis following relocation, inspect by observation the holding pool population for mortalities and viability of the population and initiate any appropriate remedial actions as deemed necessary.

4. On a bi-weekly basis in concert with item 3 above, inspect the viability of the Spring Pond Stickleback population.

5. Screens in the holding pool outlet will be inspected and cleaned as necessary on a bi-weekly cycle by the contractor.

6. The holding pool and its outlet, and Spring Pond and outlet will be inspected and cleaned of any urban debris on a quarterly cycle.

7. Any Stickleback mortalities observed in any of the above areas are to be reported to the MNHESP office.

8. During construction in Willow Pond, on a bi-weekly basis inspect the shelf area in Willow Pond for viability of any remaining stickleback population and for any impact to the shelf area habitat due to the construction activities.

9. Oversee reconstruction of the Willow Pond berm at the inlet.

10. Oversee the return of the holding pool population to Willow Pond.

11. Using seines and/or minnow traps, continue to monitor on a quarterly basis the viability of the Stickleback populations in both Willow and Spring Ponds for at least two years after the fish are returned to Willow Pond.

The Independent Environmental Monitor will submit monthly reports to the project management structure described in Section 6 of the Final EIR and will recommend any immediate remedial actions as they may be required. These reports will be summarized in the annual report.

Maintenance programs in the project area for culverts, water quality, BMPs and habitats are also discussed in Section 6. In addition to maintenance functions described in that section, the following maintenance tasks will be required for long term, post-construction monitoring:

1. The integrity of the banks around the above locations will be inspected and reported in the Annual Update, as long as Annual Updates are required;

2. The condition of the shelf area and the berm at the inlet to Willow Pond will be inspected annually.

9.11 Permittability of Rare Species Impacts under the Wetlands Protection Act

The MNHESP has determined that the proposed mitigation project will not constitute a "taking" of the Threespine Stickleback (letter from Patricia Huckery, MNHESP to Secretary Bob Durand, Massachusetts Division of Fisheries & Wildlife, dated 27 February, 2002). Therefore, the project will not require a Conservation Permit in accordance with the provisions of the Massachusetts Endangered Species Act.

However, pursuant to the Wetlands Protection Act (the WPA or Act), standards for inland wetlands (310 CMR 10.59) pertaining to projects that impact rare species habitat, a determination must be made as to whether the project meets the performance standards of the Act including a determination that the project will have no short- or long-term adverse effects on the habitat. The proponents submit that a WPA variance is not required for the reasons presented below.

9.11.1 No Adverse Impact

When work is proposed in a rare species habitat, the applicant has the burden of demonstrating that the alteration will not adversely affect the habitat of the local population of that species. Pursuant to DEP Policy 90-2 "Standards and Procedures for Determining Adverse Impacts to Rare Species Habitat," to meet this requirement the applicant must: (1) identify the rare habitat requirements of the rare species; (2) identify the habitat characteristics of the resource area and the important wildlife functions provided for that rare species; and (3) demonstrate that the proposed project will not alter any habitat characteristics which are providing important wildlife functions for the rare species. Wildlife habitat functions to be analyzed are important food, shelter, migratory or overwintering areas, and breeding areas.

9.11.1.1 Habitat Requirements of the Rare Species

Threespine Sticklebacks are found along the coast of Massachusetts in estuaries, salt marshes, and tidal creeks. They are equally at home in fresh or salt water. (D. Humphreys Stover, M.D., Reports on the Fishes, Reptiles and Birds of Massachusetts, Commision [relative to] Zoology and Botany Survey of the State, 1839. Boston [Fishes, pp. 1-2-2]). The only totally landlocked population in Massachusetts is that in freshwater ponds in Olmsted Park. It is possible this population was introduced as part of a planned natural history museum. These water bodies provided cool, relatively clean water, and other habitat elements such as abundant food supply, protective shelter and ample nesting areas. See Section 9.3 for a description of the natural history of the Threespine Stickleback.

9.11.1.2 Habitat Characteristics of the Resource Area and the Important Wildlife Functions

In Olmsted Park the Stickleback populations are established in shallow, spring-fed water. A large water body does not appear to be a requirement, evident their successful population in the small, shaded and cool water of Spring Pond. Shade from bordering vegetation and leaf litter provides shelter. The fish is omnivorous, feeding on a wide variety of food sources including small invertebrates, fish eggs, fish larvae, and small fish fry. It has apparently reproduced successfully in this habitat for over 100 years.

9.11.1.3 The Proposed Project will not alter any Habitat Characteristics

There are two Threespine Stickleback populations in Olmsted park, one in Willow Pond and the other in Spring Pond. With regard to the Spring Pond population, there is no work planned in this pond other than runoff control measures, utilizing a small, shallow settling area planned upstream of Spring Pond (described in Section 9.6). This

pool will only serve to capture urban pollutants and sedimentation from entering Spring Pond, thereby preserving vital water quality of Spring Pond (see Figure 9-2).

In Willow Pond, the shallow shelf where the Stickleback population is found will not be dredged. To protect this shelf area from nearby dredging activities and siltation, a silt screen will be installed around the shelf area. If deemed necessary, sheeting may also be installed as further protection. The sheeting will be removed only after construction is completed in order to insure the stability of the shelf. Gravel backfilling or subsurface gabions will make up any change in shelf elevation. The intent is to cause no alteration to this habitat. As a further protective measure, prior to construction, the Willow Pond Sticklebacks will be captured and held in a temporary pool that will simulate the current habitat characteristics (see Section 9.8). Upon completion of construction activities in Willow Pond, Sticklebacks will be returned (within a period of one year, but not during the breeding season) to their present, unaltered habitat adjacent to the inlet downstream of Spring Pond.

A small gravel berm will be constructed to protect the Stickleback habitat from larger fish that would return to Willow Pond once it is deepened by dredging. Similarly, the maximum water level will be controlled by a new outlet structure. This will consist of an open vertical pipe into which water will flow should the water level raise above or overtop the pipe inlet (Figure 9-3). The pipe will empty into the Babbling Brook, which flows into Leverett Pond downstream.

9.11.2 If a Variance Should be Required

Pursuant to the Wetlands Protection Regulations (Regulations) for inland wetlands (310 CMR 10.59) pertaining to projects that impact rare species habitat, a project within a habitat of a state-protected species cannot be permitted by the issuing authority unless a determination is made that the project meets the performance standards of the Regulations, including a determination that the project will have no short- or long-term adverse effects on the habitat. DEP Policy 90-2 provides guidance to applicants and issuing authorities in making that determination. As presented above, we believe the project with proposed mitigation measures will result in no short- or long-term adverse effects to the Threespine Stickleback. Should the Boston Conservation Commission or DEP not agree that the proposed activities can be authorized via an Order of Conditions, the activities in the habitat of Threespine Stickleback will require a variance pursuant to 310 CMR 10.05 (10).

Issuance of a variance is dependent upon a demonstration by the applicant that the proposed activity meets the following three criteria: (1) there is an overriding public interest, (2) alternatives are infeasible, and (3) mitigation measures exist to protect the interests of the Wetlands Protection Act. Although it is not likely that a variance is required, the following discussion is made to demonstrate that a variance can be justified if it should be required.

9.11.2.1 Overriding Public Interest

The Emerald Necklace is the last great urban park system that Fredrick L. Olmsted planned in the nineteenth century during a remarkable forty-year career that also

spawned the design and construction of Central Park in New York, Prospect Park in Brooklyn, Washington and Jackson Parks in Chicago, Belle Isle Park in Detroit, the park on Mount Royal in Montreal, and multi-park systems in Buffalo, Rochester NY, and Louisville, Kentucky.

Of Olmsted's many accomplishments, the Emerald Necklace system is considered the most complex, integrated, and cohesive system of large and small parks and parkways providing green space connections between numerous and varied neighborhoods. Listed on the National Register of Historic Places, Olmsted's Emerald Necklace parks are a preeminent example of the late nineteenth-century American Parks Movement that grew out of the need for improved quality of life in expanding urban and industrial centers that were faced with deteriorating social and sanitary conditions. The Emerald Necklace also was unique in its multipurpose functions--improving sanitary conditions and flood control, while serving as an educational resource and an active and passive recreational resource for the City and Town.

Since its creation around the turn of the twentieth century, the Emerald Necklace in general, and the area surrounding the Muddy River in particular, have been subject to the effects of gradual yet extensive urbanization. As the populations of Boston and Brookline grew, they brought with them more buildings, roadways, traffic, and congestion. The results of development on the watershed have been significant. Flooding has worsened because there is little natural storage left in the heavily paved watershed, and sediment and debris have washed into the Muddy River, choking off flood carrying capacity. Water quality has deteriorated as an array of natural and man-made compounds are carried off the land surface during rainstorms and deposited into the river. Non-native invasive species of flora such as *Phragmites* and knotweed have overtaken portions of the banks of the river, pushing out native species, creating safety hazards, eliminating natural habitats and greatly limiting the diversity of wildlife that can live within the corridor. The distinctive landscape designed by Frederick Law Olmsted has declined in richness and diversity, the present landscape lacking the subtlety and coherent massing of plant materials that once characterized the landscape. The parks in the Emerald Necklace are a designated Boston Landmark and are listed in the National Register of Historic Places. The Muddy River and the associated parkland have extremely high societal value and are within walking distance of many prominent institutions, cultural landmarks, and diverse neighborhoods.

In addition, as observed by Hartel *et. al.*, the park population of Threespine Sticklebacks is in danger of extirpation due to the impacts of urban pollution and sediment infilling of the ponds. The project as proposed will revitalize the Stickleback habitat to help insure the survival of this threatened species for generations to come.

9.11.2.2 Infeasibility of Alternatives

The proposed project presents an opportunity to enhance aquatic and riparian habitat because it would remove the present deposits of organic sediment and root mats along the shoreline which do not provide suitable habitat for the Threespine Stickleback. The proposed dredging will expose native granular sediments that will

provide improved spawning habitat. The proposed dredging will also have a beneficial impact on the spawning of anadromous fish. The Blueback Herring *(Alosa aestivalis)*, which is known to migrate up the Muddy River to Leverett Pond, spawns in the open water where the eggs sink to the bottom. Removal of contaminated sediment will increase the survival of herring eggs. Another anadromous fish, the shad, might also migrate further into freshwater and spawn on sandy pebbly bottoms in Leveret Pond once again.

The only alternative to the proposed project would be to not dredge Willow Pond. Under a no-action alternative, none of the project elements to enhance aquatic and riparian habitat would be implemented. Indigenous plant species, including emergent wetland vegetation, shoreline plants, shrubs and canopy species would not be planted. Damaged turf and shoreline would not be re-vegetated with grass and damaged or lost shrubs would not be replaced. The no-action alternative also would not include the removal of *Phragmites* and Knotweed. The original shoreline would not be preserved and plants from the Olmsted plant list would not be re-introduced. The "urbanized" wildlife habitat would remain essentially unchanged from the present, as would species diversity.

The no-action alternative would continue to impact the habitat of Threespine Sticklebacks in Willow Pond due to continually shoaling from sedimentation, varying water levels, increased water temperatures and degraded water quality. Hartel *et al* (2002) have indicated that, due to deterioration of water quality and sediment infilling, the threatened species Threespine Stickleback is in danger of extirpation within Olmsted Park. There is no reasonable alternative to this project that will protect and preserve the habitat of the Threespine Stickleback on a long-term basis in Willow Pond and Spring Pond.

An alternative that was considered to protect the Threespine Stickleback in Willow Pond was to capture and move that population from Willow Pond and relocate it into Spring Pond. However, according to Professor Hartel (Cortell, personal communication), the Threespine Stickleback population in Willow Pond is of a larger body size and a different morph from the physically smaller, Spring Pond fish. It was determined that mixing the two populations could have unpredictable negative impacts, including overcrowding, competition for food, shelter and breeding area.

9.11.3 Development of Mitigation

Mitigation plans for each of the two Threespine Sticklebacks morphs are different. For the Spring Pond population, there are no plans to perform any work in Spring Pond. The only action proposed, a sedimentation bay/settling area, will be constructed upstream of Spring Pond to improve water quality. Once completed and stabilized, the forebay will be used as the temporary (6 to 12 months) holding area for the Willow Pond Sticklebacks.

In Willow Pond, the shallow shelf area where the Sticklebacks are presently found will not be dredged. However, in order to protect the Stickleback population from any incidental impacts during construction activities that are scheduled in the main part

of the pond and around the border of the pond, it is proposed to temporarily relocate the population for a period of less than one year. The intent is that the Willow Pond Stickleback population will be carefully returned to its current habitat after proposed project improvements are completed. Mitigation plans for both areas of Stickleback habitat are discussed in detail in Sections 9.5, 9.6, and 9.7 of this report.

In conclusion, the work within the habitat of the Threespine Stickleback has been designed in compliance with the performance standards of the Wetlands Regulations. As described above, this work can comply with DEP Policy 90-2 for work within habitats of state-listed species, making it permittable via an Order of Conditions. Should it be determined that a variance is required, documentation is provided in Section 9.11.2 of this Final EIR that the variance criteria are met.

10

Section Ten

Section 10

Section 10 Environmental Mitigation and Section 61 Findings

10.1 Introduction

The proposed Muddy River Project is a long-term environmental enhancement and mitigation project that will have some unavoidable short-term construction-related impacts. The mitigation addressed in this section primarily addresses these short-term construction issues, although long-term maintenance and management commitments are also summarized as components that are critical to the longevity of project benefits.

The project consists of the following environmental enhancement and mitigation objectives:

- Provide Flood Control – Maintain the flood elevation in the Riverway at 15 ft. BCB and to remove other flow restrictions;
- Improve Water Quality Improvement – Contribute to the attainment of Class B Water Quality Standards in Muddy River;
- Enhance Aquatic and Riparian Habitat – Increase the size/volume, quality, and diversity of the aquatic and riparian habitat;
- Restore Landscape and Historic Resources – Contribute to the rehabilitation of historic landscape and historic resources while maintaining the Continuum; and
- Institute Best Management Practices for Stormwater Runoff – Reduce the pollutant loading and contribute to the attainment of Class B Water Quality Standards in the Muddy River.

In order to fulfill these objectives, it is necessary that dredging of contaminated sediments be conducted along with some infrastructure improvements. Equally important is the revegetation of aquatic and riparian habitat lands with a diverse composition of wetland, shoreline and upland plantings. The realization of this work will result in an enhanced environmental setting over that which presently exists.

The proposed construction will result in the temporary disturbance of the Muddy River, public uses of portions of the parklands, roadways and pedestrian walkways. The following environmental mitigation measures have been developed to minimize the degree of negative construction-related impacts. There are also a number of measures and plans that are proposed to ensure the long-term benefits of the construction phase of the project. The post-construction implementation plans involve the MEPA Annual Update (see Section 6), a Management and Maintenance Plan (see Section 6), and the implementation of Best Management Practices for

stormwater runoff (see Section 5), among others described in this section and in Section 6.

The MEPA Annual Update will be viewed as the compliance report, which will detail the level of compliance with the FEIR Certificate and the other permits and approvals.

10.2 MEPA Certificate and DEIR Comments

The Secretary's Certificate on the Draft EIR states that the Final EIR should include Proposed Section 61 Findings which identify:

- Specific mitigation measures;
- Parties responsible for funding and implementation; and
- A detailed implementation schedule.

The Secretary also indicated that the Findings need to include more than generic references to maintenance and management responsibilities and should incorporate the specific comments on mitigation made by the permitting agencies, in particular DEP.

Permitting agency comments related to mitigation are summarized below. A reference to the applicable section where the comment is addressed is provided.

DEP:

- Provide more detail on wetland restoration/replication (see Section 3);
- Outline corrective actions for water quality exceedances (see Section 3);
- Capture and release any fish or amphibians impounded within the work area by silt curtains (see Section 3);
- Discuss what type of sampling/decontamination will be necessary after each staging area is returned to its prior use (see Section 2);
- More fully discuss control of dust during construction (see Section 10.5.2);
- Update Table 7-1 from DEIR, Mitigation and Project Impacts (see Table 10-1);
- Discuss scope and reporting procedures for the IEM (see Section 10.4); and
- Submit DMMP to DEP for review/comment (see Section 10.5.2).

DEM:

- Define IEM's responsibilities, authority and chain of command. Needs to have authority to stop work (see Section 10.4); and

Table 10-1
Muddy River Environmental Standards Mitigation

Environmental Issue	Performance Standards/Mitigation	Reports/Plans Referencing Performance Standard/Mitigation*
General	DURING CONSTRUCTION:	
	1. Onsite environmental inspector will keep a daily log summarizing all construction and restoration activities of the project, noting turbidity conditions, sampling results, extent of sediment plume, occurrence of fish kills, and evaluation of various measures employed to reduce turbidity and other impacts to water or wetlands. Submit weekly report to Conservation Commission.	Environmental Inspection Report
	2. Street sweeping and dust control.	Environmental Inspection Report
	POST-CONSTRUCTION:	
	1. MOU committing to funding project maintenance	MOU
	2. Quality assurance program through reports and logs to document maintenance activities	Maintenance Operations Plans
	3. Provide annual updates to MEPA.	MEPA Annual Updates
	4. Certain activities to be accomplished each year will require permitting where state agencies can provide guidance on future activities	Permit applications or amendment requests
Sediment Removal and Management	DURING CONSTRUCTION:	
	1. Staging areas will be lined and runoff will be collected and treated before being discharged. Staging areas will be tested before restoration.	Supplemental Sampling of Sediment (as needed); Dredged Material Plan
	2. Dewater sediment prior to trucking. Sediment shall contain no free-draining liquids. Use Paint Filter Test, EPA Method 9095 to determine this when questionable.	
	3. Lime and foam will be provided on site at all times for odor control as needed.	Dredged Material Plan
	4. The contractor will submit MSD sheets for polymers and other products propsed for use. Use of toxic materials will not be approved.	Sediment Removal and Shipping Record
	5. TC-Lead sediments will be treated, tested and stored on site in containers prior to trucking off site for reuse or disposal.	
	6. Contractor shall submit proposed reuse or disposal facilities for review and approval by the engineer.	
	7. Cover sediment during transport by a tarpaulin or other means.	
	8. Sediment shall be accompanied to the landfill by a DEP Material Shipping Record	
	POST-CONSTRUCTION:	
	1. Same requirements for maintenance dredging as for sediment removal during initial dredging	Supplemental Sampling of Sediment (as needed); Sediment Removal and Shipping Record; Dredged Material Plan
Erosion Control	DURING CONSTRUCTION:	
	1. All landside unconsolidated, project-related materials shall be contained to prevent erosion by all practical methods, including but not limited to double-staked haybales and silt fence	Environmental Inspection Report; SWPPP; Maintenance Plan for Filter Fabric
	2. Stockpiles shall be completely covered when no activity occurs at the site for periods greater than 24 hrs	Environmental Inspection Report; SWPPP
	3. Staked silt fence and hay bale line shall enclose the entire work site, including the excavation area, stockpile area and frac tank area	Environmental Inspection Report; SWPPP
	4. Inspect barriers on a daily basis and maintain them as necessary	Environmental Inspection Report; SWPPP

Table 10-1
Muddy River Environmental Standards Mitigation

Environmental Issue	Performance Standards/Mitigation	Reports/Plans Referencing Performance Standard/Mitigation *
Erosion Control (cont.)	5. All landside disturbed areas shall be stabilized as soon as possible after construction is complete. Landward of mean high water and wetlands buffer zone, disturbed resource areas shall be secured by biodegradable erosion control mats while vegetation establishes	Environmental Inspection Report; SWPPP; Maintenance Plan for Filter Fabric
	6. If soils are disturbed >30 days, a temporary cover of rye or other grass shall be established. If the season is not appropriate for plant growth, exposed surfaces shall be stabilized by straw, snow fence or other NRCS recommended methods.	Environmental Inspection Report; SWPPP
	7. Use automatic wheel washing facility at staging areas to minimize offsite sediment transport.	Environmental Inspection Report; Dust Control Plan
	8. Implement street-sweeping using a wet-vac unit	Environmental Inspection Report; Dust Control Plan
	9. Provide stabilized entrance to staging areas	Environmental Inspection Report; Dust Control Plan
	POST-CONSTRUCTION:	
	1. Identify erosion on a frequent basis. Stabilize eroded areas as soon as possible with plantings and turf.	Maintenance Logs
	2. Before and immediately following large storms (expected to exceed 4 inches in 24 hours), staff will walk along the river doing visual inspections and removing debris from culverts and bridge openings as well as from drains or catch basins	Maintenance Logs
	3. Correction of eroded stream banks and pedestrian trails following storms of large magnitude to prevent further erosion.	Maintenance Logs
Water Quality	DURING CONSTRUCTION:	
	1. Continuous turbidity monitoring 200 ft upstream and downstream	Water Quality Monitoring and Analytical Results
	2. Weekly collection of water samples to be analyzed for TPHs, total and dissolved lead (dissolved lead shall be less than 1.0 micrograms/l, a site-specific, chronic, water quality criteria based on 40 mg $CaCO_3$/l measured at the nearest sampling location)	Water Quality Monitoring and Analytical Results
	3. Weekly measurements of water temp, pH, and DO	Water Quality Monitoring and Analytical Results
	4. Weekly sampling of filtrate for analysis of TSS, total and dissolved lead, and DO. To be suitable for discharge, filtrate shall have a TSS < 40 mg/l, dissolved lead < 1.0 micrograms/l, and a minimum DO of at least 5 mg/l. Filtrate shall be discharge into the Muddy River within a silt-curtained enclosure equipped with an oil-absorbent boom	Water Quality Monitoring and Analytical Results
	5. A request for 36-hr turnaround time for lab analysis of samples.	Water Quality Monitoring and Analytical Results
	6. Minimize turbidity and other water quality impacts by using a floating boom with attached silt curtain and oil absorbent boom	Water Quality Monitoring and Analytical Results
	7. Maintain silt curtain in good operating condition, rest it on the mudline at all times, and secure it to a seawall.	Water Quality Monitoring and Analytical Results
	POST-CONSTRUCTION:	
	1. Conduct annual water quality sampling consisting of quarterly (seasonal) sampling events at specified areas along the river and at drainage outfalls. During each quarter, water quality samples will be collected during a dry period, during precipitation, and the day following precipitation event. Sample for fecal coliform, fecal streptococcus coliform, TSS, true and apparent color, total phosphorus, orthophosphate phosphorus, turbidy, alkalinity, acidity, ammonia nitrogen, nitrate-nitrite nitrogen, metals, TPH-EPH. Data will be used to monitor water quality as related to meeting DEP Class B waters.	Water Quality Monitoring Program

Table 10-1
Muddy River Environmental Standards Mitigation

Environmental Issue	Performance Standards/Mitigation	Reports/Plans Referencing Performance Standard/Mitigation*
Wetland and Upland Plantings	DURING CONSTRUCTION:	
	1. Protect mature upland trees and shrubs (except Japanese knotweed) within and adjacent to project areas to their drip lines.	Environmental Inspection Report
	POST-CONSTRUCTION:	
	1. Contractor shall be responsible for successful restoration of disturbed areas for 2 years after construction. After 2-year period, proponents are responsible.	Report on Plantings
	2. Report on plants one, three, and five years after planting to assess success and adjust planting effort as necessary.	Report on Plantings
	3. Once inspection program is established, continue on a three-year cycle and report in MEPA Annual Update.	Report on Plantings
	4. Monitor and control success rate for controlling invasives by documenting where they have started regrowing 3 times per year. As needed, control by cutting, hand application of state-approvied herbicides, and hand removal (note: experienced contractors will be used for herbicide control)	Report on Plantings
	5. Watering, pruning, fertilizing, mulching, pest control, winter protection, use of ground covers, and integrated pest management will be performed on a regular basis.	Report on Plantings; Pest Control Programs
Fish and Benthic Resources (including Rare Species)	DURING CONSTRUCTION:	
	1. No dredging shall occur between March 1 and June 15 of any year to protect migration of river herring, rainbow smelt and blueback herring	Environmental Inspection Report
	2. Fisheries biologist to inspect temporary holding pool of three-spine stickleback and report monthly to IEM.	Environmental Inspection Report
	3. IEM to oversee capture and transfer of sticklebacks, inspect viability of population, and oversee return of holding pool population to Willow Pond	Environmental Inspection Report
	POST-CONSTRUCTION:	
	1. Biologist will visit the site several times in the early and late growing seasons to document wildlife use of the habitat.	Report on Aquatic and Wildlife Distribution
	2. Monitor three-spine stickleback viability in Willow and Spring Ponds for 2 years following construction.	Report on Aquatic and Wildlife Distribution
	3. Inspect integrity of banks around Spring and Willow Ponds annually	Annual Report
	4. Inspect condition of shelf area and berm at the inlet to Willow Pond annually	Annual Report
	5. Note and report any Stickleback mortalities annually.	Annual Report
Wildlife Resources	POST-CONSTRUCTION:	
	1. Pest and rodent control through public education; local ordinances against feeding ducks and geese; planting of suitable species to form a barrier between water and land; and implemnetation of reproductive control on goose population by state and federal game officials.	Pest Control Programs
	2. Biologist will visit the site several times in the early and late growing seasons to document wildlife use of the habitat.	Report on Aquatic and Wildlife Distribution
Flood Control	DURING CONSTRUCTION:	
	1. In the event of a significant storm, operations to maintain river flow will be implemented.	Dredged Material Plan

Table 10-1
Muddy River Environmental Standards Mitigation

Environmental Issue	Performance Standards/Mitigation	Reports/Plans Referencing Performance Standard/Mitigation[a]
Culvert Maintenance	POST-CONSTRUCTION:	
	1. Conduct preventative inspections prior to major storms and twice per year outside specific storms. Clear blockages.	BMP Monitoring and Maintenance Logs
	2. Inspect culverts once per year for structural conditions (crack, erosion, settlement).	BMP Monitoring and Maintenance Logs
	3. Ensure annual review of operating policy for Boston Gatehouse #1.	BMP Monitoring and Maintenance Logs
Source Control and Treatment Control BMPs	POST-CONSTRUCTION:	
	1. Update database continuously regarding new construction, location, structural integrity nad sediment deposition rate for each catch basin	BMP Monitoring and Maintenance Logs
	2. Maintain street sweeping programs.	BMP Monitoring and Maintenance Logs
	3. Replant grass and vegetation every spring or fall along desire lines	BMP Monitoring and Maintenance Logs
	4. Ongoing public education to ensure current and future residents are informed about herbicide and pesticide use management, proper disposal of litter, pet wastes, and household hazardous matierals	BMP Monitoring and Maintenance Logs
	5. For vegetated swales, regular mowing of the grass, no shorter than twice the design flow depth (typcially 4-6 inches)	Maintenance Logs
	6. Inspect swales monthly to check for inlet plugging and signs of erosion. If erosion is occurring, stabilize eroded side slopes and/or bottom.Keep swales free of debris. Reseed damaged areas as soon as possible. Also dethatch swale bottom; thatch, disc or aerate swale bottom; mutirent and pesticide use management. Every 5 years scrape swale bottoms and remove sediment to restore cross-section and infiltration rate.	Maintenance Logs
	7. For particle separators, conduct seasonal inspections for the first year of operation to establish appropriate maintenance schedule. Thereafter, clean system annually depending on weather and site activity; however, cleaning just prior to winter salting and sanding is recommended.	BMP Monitoring and Maintenance Logs
	8. Maintain catch basin cleaning programs.	BMP Monitoring and Maintenance Logs
	9. Monitor sand bar formation every year in sedimentation basins. Programming for maintenance dredging should be started when sedimentation has accumulated to about 50% of the basin's initial capacity. Measure basin shapes and depths at the end of construction. Once per year, set up a grid to measure sediment depths at each basin and estimate remaining basin volume.	BMP Monitoring and Maintenance Logs
Noise Control	DURING CONSTRUCTION:	
	1. Comply with noise ordinances	Environmental Inspection Report
	2. Measure noise levels at Brookline Ave. culvert	Environmental Inspection Report
	3. Noise abatement provided on construction equipment	Environmental Inspection Report
Pest Control	DURING CONSTRUCTION:	
	1. Certified pest control specialist to conduct weekly inspection and file reports regarding control efforts	Pest Control Plan
Traffic Management	DURING CONSTRUCTION:	
	1. Police supervision for equipment mobilization to/from staging areas	Traffic Management Plan
	2. One-lane closures only (or at night)	Traffic Management Plan
	3. Follow designated haul routes	Traffic Management Plan
	4. Limited contractor parking (no more than 6 spaces for RE, inspectors, mgt personnel). No travel lanes will be blocked for parking. Encourage carpooling.	Traffic Management Plan
	5. Full restoration of sidewalks and paths	Traffic Management Plan

[a] Primary document referencing and/or reporting on the performance standard

- Include mitigation measures that protect historic and cultural resources in the project area (see Section 7).

In addition to the above, the Secretary's Draft and Final Records of Decision, summarized in Section 10.3 and contained in Appendix B, contain conditions that, although specific to Charlesgate, are also relevant to subsequent project elements and are therefore addressed in this section.

10.3 Draft and Final Records of Decision

10.3.1 Draft Record of Decision

The Draft Record of Decision (DROD), issued on April 16, 2002 by the Secretary of Environmental Affairs, proposed to grant a Phase One Waiver allowing the Charlesgate element of the project to proceed to permitting prior to submission of the final EIR. The DROD set forth six conditions (5a through 5e) for approval of the Charlesgate element of the project as follows:

5a. Creation of a workplan and schedule for implementation and maintenance of basin-wide non-structural BMPs;

5b. The Draft EIR does not include detailed discussion of maintenance issues for the Charlesgate element. The workplan needs to expand upon the Draft EIR treatment of maintenance for the Charlesgate element, and address any permitting requirements of the Metropolitan District Commission;

5c. Commitment to completion of basin-wide evaluative studies for potential structural Best Management Practices (BMPs) during calendar year 2002, to ensure that the results of the studies will be fully reflected in the Final EIR;

5d. To maintain the project schedule described in the Draft EIR and prevent undue segmentation, the Final EIR needs to be submitted to EOEA no later than January 31, 2003;

5e. Creation of a dedicated funding source to support the levels of basin-wide BMP implementation and other maintenance measures required to prevent future degradation of the resources and the planned improvements. As suggested by the Town of Brookline, the funding commitment should be evidenced through amendment of the MOU;

5f. Implementation of a management structure, through the creation of a permanent independent oversight body, representing the full range of stakeholders. This body should contain at a minimum the following members: Boston and Brookline parks agencies; Metropolitan District Commission; EOEA; DEM; Emerald Necklace CAC representatives from both communities; Boson and Brookline Greenspace Alliances; Massachusetts Historical Commission; Boston Landmarks Commission; Brookline

Preservation Commission; Emerald Necklace Conservancy; Charles River Watershed Association; and Boston Society of Landscape Architects. The oversight body shall have an independent staff, funded by the proponents.

10.3.2 Response to Draft Record of Decision

All six of the above requirements were addressed by the proponents in letters dated May 21, 2002 and July 1, 2002 (see Appendix B). Because most of the requirements are pertinent to implementation of subsequent project elements (i.e., beyond Charlesgate), a summary is provided below, with references to other Final EIR sections as appropriate.

- With respect to condition 5a, the proponents prepared a workplan and schedule for implementation and maintenance of the basin-wide non-structural BMPs. BMP maintenance is specifically addressed in Section 6 of this Final EIR.
- To address condition 5b, the City provided copies of the construction specifications for Charlesgate maintenance and the draft permit from MDC. The contractor for Charlesgate will provide all park maintenance for two years following acceptance of planted material. It is anticipated that a similar requirement will be made of contractors for subsequent project elements.
- To comply with condition 5c, the proponents included a scope of work describing the study of structural BMPs on a basin-wide basis, including a pilot study of the efficiency of structural BMPs to meet expectations of sediment removal. The results and status of this study are discussed in Section 5 of this FEIR. The schedule of the pilot program extends beyond this Final EIR.
- In response to condition 5d, the proponents committed to filing the FEIR with MEPA by January 31, 2003 and to continue working with the CAC and TAC.
- With respect to condition 5e, both the Brookline Board of Selectmen and the Mayor of Boston submitted letters reiterating their commitment to the project (see Appendix B).
- To meet condition 5f, the proponents agreed to support a Muddy River Environmental Improvements Committee to facilitate communication and ensure that all project goals are met (see below and Section 6).

10.3.4 Final Record of Decision

In the Final Record of Decision issued on July 29, 2002, the Secretary stated that the proponents met the first five (5a through 5e) of the six requirements, enabling EOEA to issue a waiver for the first element of the project – Charlesgate.

With respect to condition 5a, the Secretary stated that issues involving towing policy should be addressed in the Final EIR. With respect to condition 5c, the Secretary indicated that the FEIR should fully evaluate the effectiveness of a wide range of

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structural BMPs within the Muddy River watershed area. With respect to condition 5f, the Secretary indicated his pleasure that the proponents committed to establishment of an independent oversight committee, but stated that further discussion of the committee's structure and function is needed in the Final EIR. While the Draft ROD envisioned "implementation of a management structure through creation of a permanent independent oversight body'" the Final ROD clarified the role of this committee in relation to both existing committees (CAC, TAC) and the proponents. The Final ROD clarified that management responsibilities will remain with the property owners and that the oversight committee "should extend a sufficient time beyond the completion of improvements described in the Final EIR (at a minimum five year)" as opposed to being a "permanent body."

10.3.5 Response to Final Record of Decision

In response to the Secretary's comment on towing policy, the Draft EIR calls for enforced car towing. In Brookline, car towing is common during periods when overnight parking is banned, regardless of street sweeping practices. Towing specifically to enhance street sweeping is seldom needed. Boston has taken an increasingly aggressive approach regarding car towing, and enforcement is expected to continue. The Boston Parks and Recreation Department (BPRD) will continue to work with Boston Traffic to improve street sweeping (which incorporates towing).

An update on the status of the proponents' compliance with the Final ROD is summarized in a letter dated November 27, 2002 from the proponents to the MEPA office. This letter is included in Appendix B. The letter identified members of a new Environmental Improvements Committee (to serve as the independent oversight committee), summarized correspondence and meetings (four between October and December 2002) with the members, described the funding strategy for committee staff, and identified a site for staff and meetings.

Structural BMPs are addressed in Section 5 of this FEIR.

The management structure is discussed in Section 6 of this FEIR. The proposed management structure is a Public/Private Partnership with Boston, Brookline and MDC as the public entity and the Emerald Necklace Conservancy (ENC) as the private entity. The management structure for overseeing the Muddy River area is designed to ensure that the project goals are met through centralized management and appropriate responsibility for long-term maintenance activities.

10.4 Mitigation Management

Management of the Muddy River Project will include the project proponents (City of Boston and Town of Brookline) as well as the MDC and the Department of Environmental Management. The Boston Parks and Recreation Department (BPRD) will serve as the contracting agency and will administer the Project, beginning with the construction contract for Charlesgate. Should the Army Corps of Engineers fund the Project, the ACOE will administer the contract(s) for the major construction

contracts (e.g., culvers and dredging). The BPRD, assisted by the Town of Brookline and the Boston Water and Sewer Commission, will administer the construction of structural BMPs as well as minor project elements that are not included in the ACOE construction contract(s). As part of this structure, proponents, ENC, proponents' Project Manager, and Resident Inspector will be responsible for managing the Contractor's operations and ensuring adherence to contract provisions to mitigate construction impacts. The on-site Resident Engineer will monitor work and report any deficiencies to the Proponent Administrator for corrective action with the Contractor.

To ensure compliance with the requirements of all the project's environmental permits and approvals, an Independent Environmental Monitor (IEM) will be retained by the Project Proponent as part of the on-site inspection team to work with the Resident Engineer. The IEM's responsibilities include conducting the environmental inspections (the Contractor will conduct the monitoring and submit the results to the IEM), coordinating with Conservation Commissions with jurisdiction, the review agencies, and preparing and submitting the periodic inspection reports. The IEM will report deficiencies to the Proponent Administrator with the Resident Engineer.

The Contractor's environmental submittals and data will be reviewed as directed by the management team for compliance with contract documents and permit conditions including mitigation measures.

10.5 Environmental Mitigation for Construction Activities from the Back Bay Fens Through Wards Pond

10.5.1 Overview

This subsection addresses the mitigation measures that will be implemented to control construction-related impacts. The construction activities will include dredging, daylighting, culvert enlargement and replacement, shoreline stabilization, the placement of muck soil for the establishment of wetland and shoreline plantings and the planting of the wetland, shoreline and upland vegetation, the restoration of historic islands, and other activities for the preservation of historic features of the Emerald Necklace.

The following plans will be submitted by the Contractor, and will reference appropriate mitigation commitments. Each plan will be reviewed and accepted by the proponents prior to construction.

- Dredged Material Plan
- Stormwater/Dewatering Pollution Prevention Plan
- Environmental Monitoring and Sampling Plan
- Plan for Monitoring of Wetland, Shoreline and Landscape Restoration
- Pest Control Plan
- Traffic Management Plan

- Transportation and Disposal Plan
- Plan for Monitoring of the Three-Spine Stickleback
- Public Outreach Program

10.5.2 Dredged Material Plan

The sediments to be dredged have been characterized to determine the appropriate management activities for their removal from the Muddy River, dewatering, and ultimate disposal. The quality of the sediment varies. In some locations, and within short distances, sediment that meets the DEP's unlined landfill criteria can be adjacent to TCLP toxic sediments. Each of these conditions requires different management actions. Therefore, in order that the Contractor state its plans for the proper management of such materials, the Contractor will be required to submit a Dredged Material Plan. The Plan will be the Contractor's commitment for environmental compliance and will contain the following information:

- Project Objectives
- Existing Sediment Quality
- Existing Water Quality
- Existing Aquatic, Wetland, and Upland Biological Resources
- Historical and Architectural Resources
- Structural and Geographic Limitations to Dredging, Equipment, and Materials Management
- Dredged Materials Management
  - Proposed Dredging Methods
    - Hydraulic
    - Excavator
    - Dredging Equipment and Performance Criteria
    - Compatibility of the Dredging Equipment With the Disposal Methodology
  - Dredging Sequence
  - Dewatering and Sediment Stabilization
  - Water Quality Mitigation Measures During Removal of the *Phragmites* Root Mass and Hydraulic Dredging, Siltation Control
- Upland Support Requirements, Staging Areas
- Operational Controls
  - Traffic Management
  - Truck Queuing and Engine Idling Restrictions
- Pedestrian Movement
- Trash and Debris Removal
- Noise Control (including vibration)
- Dust Control
- Odor Control
- Repair of Damaged Landscaping and Vegetation
- Schedule
- Mobilization
- Regulatory Requirements

- Water Quality Monitoring
- Parkland Monitoring
- Contingency Plan In the Event That Uncontrollable Environmental Problems Occur
- Emergency Response Plan and a Spill Prevention Control Containment and Countermeasure Plan (Title 29 CFR 1910.120 of OSHA Standards, 40 CFR 112, FEMA Emergency Plan Requirements, Section 105 of CERCLA, Massachusetts Right-to-Know Act and other local, state and federal requirements, as appropriate).

At space-limited locations where dredging with excavators will be necessary, the area will be enclosed with a silt curtain to prevent the downstream spread of turbid water and its potential flow into the Charles River. A silt curtain will also be maintained at the conduit under Storrow Drive to prevent floating debris and sheens from entering the Charles River. Oil absorbent materials will be maintained at the booms. The silt curtain and absorbent materials will be inspected daily. Accumulated debris and trash will be removed daily and the absorbent pads will be replaced as needed.

The Dredged Material Plan will address dust control including such measures as:

- Use of automatic wheel washing facility at staging areas to minimize offsite sediment transport;

- Implementation of street-sweeping using a wet-vacuum unit; and

- Provisions to provide a stabilized entrance to staging areas.

The Dredged Material Plan will be submitted by the Contractor for review and acceptance and will also be provided to Yvonne Unger at DEP, in compliance with the anticipated 401 Water Quality Certification.

10.5.3 Stormwater/Dewatering Pollution Prevention Plan

It is anticipated that the Contractor will form staging areas by placing a 4- mil HDPE liner with layers of sand and crushed stone over the existing ground. As such, the underlying soil will remain essentially undisturbed and will not be subject to erosion. Each staging area for dredging will contain sedimentation tanks, pumps, coagulant polymer feed systems, belt filter presses, water filters, conveyor belts for truck loading, a field office, and limited construction personnel parking (no more than 6 spaces for Resident Engineer, Inspectors, Contractors, and Management personnel). Staging areas not used for dredging will include trailers and materials staging for contractor's work. All work will be conducted from the staging areas. Truck queuing will take place off-site. More intense typical construction activities will occur at the Fens Bridge and former Sears parking lot sites due to the large amount of excavation, rip-rapping, grading, and plantings that are necessary for the daylighting and culvert enlargement. In addition, at the former Sears parking lot, piles will have to be driven to form the foundation for the arch culvert.

The staging area runoff will be contained by the use of silt fences and hay bales. The Contractor will be required to provide a stabilized entrance to the staging area equipped with a wheel wash in order to prevent tracking of soil and dust onto local streets. Water from the wheel wash will be detained in a sedimentation tank for settling before being discharged to the Muddy River. Regular street sweeping and other Construction BMPs (such as use of calcium chloride to reduce dust) also will be required to control runoff from construction areas. The condition of the erosion controls and the streets will be inspected and documented daily.

Prior to final approval by the Department of Environmental Protection (DEP) and the Boston and Brookline Conservation Commissions, the Contractor will be required to submit a Stormwater/Dewatering Pollution Prevention Plan (S/DPPP). The S/DPPP will contain an Erosion and Sedimentation Control Plan and a Spill Prevention Control, Containment and Countermeasure Plan that would be specific and applicable to each staging area. These plans will state the Contractor's intent for managing site runoff, monitoring, and maintenance.

As soon as the work in the section of the Muddy River being served by a staging area is completed, the site will be restored and revegetated as shown in the Preliminary Design Report (see Appendix I of the Draft EIR). During restoration, erosion control measures will be maintained as removal of work surface could lead to additional erosion.

Weekly Environmental Inspection Reports that contain the results of the site inspections, the progress of the work, anticipated work for the following week, the results of water quality monitoring and other pertinent details will be submitted to the proponents, DEP, ACOE (if involved), and both Conservation Commissions, as appropriate.

On an as-needed basis, site walks with representatives of DEP, ACOE (if involved), and both Conservation Commissions will take place to review on-ground conditions.

10.5.4 Environmental Inspection Report

The potential for short-term water quality impacts will be present wherever dredging and earthwork is undertaken. In order to be able to take appropriate measures to minimize unanticipated water quality disturbance, monitoring of the Muddy River will continue through all phases of construction, plus two years following the stabilization of the restored ground and banks. The construction period water quality monitoring will be in addition to the Muddy River Water Quality Monitoring Program that will take place before, during, and after construction has been completed. (see Section 6 - Management and Maintenance Plan).

Construction water quality monitoring will include the following:

1. Continuous monitoring of suspended solids with appropriate meters, 200 feet upstream and 200 feet downstream of the discharge of dewatering pressate;

2. Weekly monitoring of all discharges from sedimentation tanks, dredged material dewatering equipment, and the Muddy River upstream and downstream of the dredging operation(s). Water samples will be collected and analyzed for:

   Temperature (field test)
   Dissolved Oxygen (field test)
   pH (field test)
   Total Petroleum Hydrocarbons (laboratory test)
   Total Lead (laboratory test)
   Dissolved Lead (laboratory test)

3. The monitoring results will be attached to a weekly BMP Inspection Report (see S/DPPP) that is submitted to the DEP and the Boston and Brookline Conservation Commissions.

10.5.5 Parkland Monitoring

To ensure that the Contractor's activities and equipment remain within the allowed construction limits, the final design plans will contain specifically marked limits of construction. These limits of construction will be prepared by the engineer and landscape architect and will be placed such that the necessary entry into parkland does not adversely impact sensitive vegetation, heritage trees and historic features, nor lead to adverse water quality impacts. During construction, the IEM will monitor the Contractor's activities to ensure that the work remains within the designated limits of construction.

10.5.6 Plan for the Monitoring of Wetland, Shoreline, and Landscape Restoration

The purpose of the Plan for the Monitoring of Wetland, Shoreline, and Landscape Restoration is to ensure the rapid discovery of developing concerns, whether it is erosion or die-off of vegetation, and the equally rapid correction. The Contractor will be responsible for the restoration of all disturbed areas including, but not limited to, staging areas, access points, shorelines, and other areas that were disturbed by construction and restoration activities. The Contractor will provide a qualified horticulturist/arborist, and Certified Wetland Scientist to conduct weekly inspections during construction progress of the bank stabilization and the planting of wetland, shoreline and upland vegetation. The inspections will be conducted with the Resident Engineer or designee. Inspections may also be conducted with the DEP, and the Conservation Commissions as required. Noted exceptions and areas of concern will be corrected within one week, or sooner if the Resident Engineer or regulatory authority deem necessary. The Contractor will provide Inspection Reports, which contain maps of the plant beds, field notes and logs describing the corrective measures that were taken, if any, and quantities of materials that were used, as well as locations where they were applied. The Contractor will provide a two-year guarantee for the success of the soil stabilization and all plantings.

10.5.7 Pest Control

The stands of *Phragmites* throughout the project area and adjacent areas (i.e. Back Bay Fens near the Victory Gardens and the Fire Alarm Headquarters/Boston Emergency Management Office) contain rats, muskrats and other rodents. In order to prevent the displacement of rodents to adjacent areas where they may become a nuisance to park users and area residences, the Contractor will conduct a program to control rodents within the Project Limits. The Contractor will conduct the rodent control program in a cooperative manner with the interest groups that operate within the Emerald Necklace Parks. Positive steps will be taken to ensure the safety of pets from the baits. The Contractor will employ a pest control supervisor who is licensed and certified by the Massachusetts Pesticide Bureau in General Pest Control (Category 41) and Vertebrate Pest Control (Category 44). Weekly inspection/survey reports will be filed with the Resident Engineer showing locations of bait stations, the amount of bait used, conclusions and recommendations.

10.5.8 Public Outreach Program

Throughout the course of the construction period there will be a regular outreach program in order to keep abutters informed of the progress of the work as well as the upcoming schedule. Public Meetings will be held regularly to allow for the opportunity for discussing issues during, and following, the construction period. The meetings will also allow for the opportunity for the expression of problems and/or concerns during, and following, the construction period. The Resident Engineer will provide regular, and timely, updates to the proponent for release to the local media.

The proponents also plan to provide descriptive boards and signage describing the project and the ongoing work as part of the program to keep the public informed.

10.5.9 Traffic Management Plan

The following traffic- related mitigation is proposed:

- Equipment mobilization to/from the staging areas and the areas of culvert construction will require police supervision as a safety precaution. For trucks entering and exiting the staging area where a sidewalk crossing occurs, the contractor will be required to provide a ground guide.

- Culvert construction across The Riverway will require lane closures and will be restricted to no more than one-lane closure at a time. Signal timing adjustments will be needed at several intersections through the Sears Rotary as a result of these lane closures.

- When construction of the Brookline Avenue culvert (at former Sears parking lot) is within the existing traveled way, lane closures cannot occur during daylight, so work will take place at night. Night work will allow lane closure and/or construction of temporary lanes to expedite work. Contractor will be required to

replace a bridging slab over the roadway so all lanes in the traveled way will reopen during the day.

- Work at the Brookline Avenue culvert will be considered for daylight weekend work during lower traffic times except when it conflicts with baseball games or major institution functions in the area that would generate excess weekend traffic.

- Contractors must be required to follow the designated truck haul routes. This will help minimize truck traffic on residential roadways not appropriate for truck traffic.

- Truck queuing will not be allowed on local roads and side streets. The Contractor will provide for an off-site truck queuing location and radio control.

- State law, the City of Boston's ordinance and Town of Brookline's Noise Bylaw regarding idling of truck engines will be enforced.

- All sidewalks and paths will be fully restored once construction activity has ended.

- Limited contractor parking (no more than 6 spaces for Resident Engineer, Inspectors, Management personnel) will be provided either within the bounds of an active staging area or off-site (at a location to be determined). At no time will contractors be allowed to block a travel lane for parking. A carpooling plan is strongly encouraged, whereby only one or two contractor vehicles are parked within the staging area and other vehicles are off-site.

- Pedestrian access on Netherlands Road and Agassiz Road will be maintained while these roads are temporarily closed and used as staging areas for construction equipment.

- At the intersection of The Riverway at Brookline Avenue, there are existing capacity deficiencies that are expected to be exacerbated while Netherlands Road is closed and used as a staging area. The predominant level-of-service and delay degradation is expected to occur to the left-turning movements from Brookline Avenue onto The Riverway. The following mitigation should be considered to alleviate these impacts

- Redesignate The Riverway northbound at Brookline Avenue approach right-turn only lane as a shared through/right-turn lane. This will require modification to the signal phasing.

- Consider upgrading the traffic signal equipment and providing an exclusive left-turn phase for both eastbound and westbound traffic on Brookline Avenue (currently, the westbound approach has a short lead phase).

- The Resident Engineer will regularly coordinate with other local businesses and organizations which impact traffic such as Fenway Park, MASCO, Emmanuel College, etc.

10.5.10 Habitat Protection, Mitigation, and Enhancement for the Three Spine Stickleback

As discussed in Section 9, the three spine stickleback, a threatened species of fish listed by the Massachusetts Natural Heritage Program, inhabits Spring Pond, its outlet stream and a small area at the inlet of Willow Pond. A one and one-half to two foot high stone dam that is in need of repair, separates Spring Pond from Willow Pond. Spring Pond is kept considerably cooler than Willow Pond by the discharge of groundwater into the Spring Pond. Willow Pond also has watercress and a small amount of filamentous algae growing in it.

The proposed project elements at Willow Pond were discussed with the Natural Heritage Program staff, reviewed in the field and further discussed in telephone conversations. Through these and other efforts, opportunities were observed where the habitat conditions for the three spine stickleback can be protected as well as enhanced. The Natural Heritage Program requested that a habitat protection, mitigation and enhancement effort be conducted. The protection, mitigation, and enhancement effort which will be conducted by the Contractor, will be coordinated with the Natural Heritage Program staff and includes the following:

- Capture of Sticklebacks inhabiting the inlet to Willow Pond below the Spring Pond dam and relocating them to a temporary holding pool;
- Restoration of the historic Willow Pond capacity by dredging 5,900 cy sediment;
- Removal of invasive vegetation around Willow Pond;
- Preservation of the shelf habitat of the Stickleback in Willow Pond with sediment curtains and sheeting;
- Addition of a small gravel berm at the edge of the shelf habitat to define the outer edge of the Stickleback pool in Willow Pond;
- Installation of a water level controlling discharge pipe in Willow Pond;
- Creation of a small pool or settling area for Sticklebacks temporarily relocated from Willow Pond;
- Preservation of the historic park features at Willow Pond by revegetation of the new bank, reintroduction of an island in Willow Pond, and establishment of wetland areas and restoration of terrestrial habitat with indigenous plantings;

- Control of sedimentation that is entering Spring Pond from the adjacent bank and pathways; and

- Reconstruction of the stone dam between Willow Pond and Spring Pond.

Further information is provided in Section 9 of this Final EIR.

10.5.11 Noise Mitigation at Brookline Avenue Culvert

One of the more significant noise-generating activities is installation of piles for the culverts. Construction of the culvert under Brookline Avenue near the former Sears parking lot will include a combination of day and nighttime work due the difficult traffic conditions at the Sears Rotary. As described in Section 5 of the Draft EIR, work on either end of the culvert can be constructed during the normal daytime construction period since there is sufficient room in adjacent park areas for mobilization and work areas. When constructing the across the Brookline Avenue, constructing new temporary lanes for traffic will result in significant traffic impacts unless done at night time.

In order to mitigate noise impacts on residences in the area the following noise mitigation measures will be undertaken:

- Regulation for the Control of Noise in the City of Boston will be followed for construction activities in Boston. The Brookline Noise Bylaw will also be followed for work in Brookline. A permit will be sought for any nighttime construction, as appropriate.

- Noise measurements, using appropriate field sound equipment will be carried out by the contractor on a weekly basis. The IEM will be provided these results and may request to witness the measurements. Should noise levels exceed the allowed limit measured at locations indicated in the regulations, the contractor will take steps as necessary to reduce noise to levels acceptable to the Resident Engineer and responsible municipal officials.

- All construction equipment will be fitted with suitable mufflers and similar noise abatement devices prior to receiving approval to commence work.

Installation of foundation piles will be required to use drilled piling techniques to reduce noise levels. Sheet piling will use vibrating driving equipment to reduce noise levels. Foundation piles and sheet piling work will not occur after to 11:00 PM, or will be limited to on weekends when traffic impacts are reduced and work can be accomplished during daytime hours.

10.6 Draft Section 61 Findings

As decreed by the Secretary, draft findings pursuant to M.G.L. Chapter 30, Section 61, are presented herein. This statute requires state agencies, which permit or fund projects for which an Environmental Impact Review is conducted under MEPA, to

make certain "findings" with respect to how detrimental impacts of the project have been avoided, minimized and mitigated. The findings must reflect the information disclosed through MEPA documentation and must relate to the subject matter jurisdiction of the permitting agency. Thus, the state permits to be issued by the Department of Environmental Protection for dredging and for water quality certification required the DEP to issue Section 61 findings. The following contains proposed findings for consideration by the DEP.

DRAFT

**MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
FINDINGS PURSUANT TO
M.G.L. CHAPTER 30, SECTION 61**

PROJECT NAME:	**The Phase I Muddy River Flood Control, Water Quality and Wildlife Enhancement and Historic Preservation Project**
PROJECT LOCATION:	**Boston and Brookline, MA**
PROJECT PROPONENT:	**Boston Parks and Recreation Department; Town of Brookline, MA**
EOEA NUMBER:	**11865**

BACKGROUND
The primary impacts associated with the project are beneficial, including critically needed improvements in flood control infrastructure, rehabilitation of one of the world's great works of landscape architecture, along with improvements in water quality and wildlife habitat. However, proposed rehabilitation will result in the temporary disturbance of the Muddy River, public use of portions of the parklands, roadways, and pedestrian walkways.

PROJECT DESCRIPTION
Construction activities that are proposed within the project area include:

- The formation of staging areas for dredging equipment including belt filter presses and other appurtenances,
- The dredging and removal of accumulated sediment and debris,
- The restoration and re-vegetation of the staging area upon completion of the work,
- The planting of new vegetation,
- The repair or replacement of worn pathways, and
- Installation of new park benches.

The proposed construction and revegetation activities are shown in the Preliminary Design Report that is included in Appendix I of the Draft Environmental Impact Report (DEIR).

PROJECT IMPACTS
A detailed analysis of project impacts was provided in Section 6 of the DEIR. Generally, the long-term impacts of the project will be beneficial, resulting in:

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- Improved flood control
- Improved water quality
- Enhanced biological environment

Short-term impacts during the construction period will include the following:

- Temporary water quality impacts from the staging area, from dredge and debris removal locations, and from the return water.
- Temporary impact to vegetation at the staging area and adjacent to the river.
- Temporary impact to the limited aquatic and wildlife resources which exist.
- Temporary impact on recreational use and pedestrian access.

MITIGATION MEASURES

Performance standards to be met and other measures to mitigate construction-related impacts and to ensure continuation of post-construction benefits are listed in Table 10-1. The table also indicates in which reports or plans the specific measures will be addressed.

IMPLEMENTATION SCHEDULE

Construction phasing for planning purposes on the Phase I Project is currently assumed to be a single construction contract with bidding in early 2003 (following issuance of the MEPA Certificate on the Final EIR), construction start in 2003 (after receipt of all permits) and completion of construction in 2006. This schedule is dependent on appropriation of federal, state, and municipal capital funds.

No construction will begin until all contractor plans have been submitted and approved.

Monitoring and reporting will be completed during construction, and beyond construction, as discussed further in this section and Section 6.

FINDINGS

For the reasons stated above, DEP hereby finds that, with implementation of the mitigation measures described above by the City of Boston, all practicable means and measures will be taken to avoid, minimize, and mitigate sewage related impacts to the environment resulting from the Proposed Phase I Muddy River Flood Control, Water Quality and Wildlife Enhancement and Historic Preservation Project. Appropriate conditions will be included in the Chapter 91 permit and Water Quality Certification to be issued by DEP to describe more fully and ensure implementation of said measures.

Date	Appropriate Signature

11

Section Eleven

Section 11
Responses to Draft EIR Comments

This section contains responses to comments contained in: (1) the Secretary's Certificate on the Draft EIR (April 16, 2002); and (2) letters sent to MEPA on the Draft EIR by individuals and organizations. The comments and responses are presented in tabular form and are indexed to reference the full Certificate and comment letters in Appendix A.

A list of the indexed comment letters is provided on the following page.

Muddy River DEIR Comment Index

A	April 16, 2002, Secretary's Certificate on the Draft Environmental Impact Report
B	February 27, 2002, Massachusetts Division of Fisheries and Wildlife
C	March 4, 2002, Edward B. Cutler (CAC Member)
D	March 8, 2002, Massachusetts Division of Marine Fisheries
E	March 14, 2002, Lisa Tucker-Kellogg
F	April 2, 2002, Town of Brookline Department of Public Works
G	April 3, 2002, Brookline GreenSpace Alliance
H	April 8, 2002, Northeastern University
I	April 8, 2002, Medical Academic and Scientific Community Organization, Inc.
J	April 8, 2002, Friends of the Muddy River
K	April 5, 2002, Frances Shedd-Fisher
L	April 5, 2002, Arleyn Levee Landscape Consultant
M	April 8, 2002, Fenway Studios, Inc.
N	April 8, 2002, Boston GreenSpace Alliance
O	April 8, 2002, Emerald Necklace Citizens Advisory Committee
P	April 8, 2002, City of Boston, The Environment Department
Q	April 8, 2002, Bike Boston's Emerald Necklace Greenway Project
R	April 5, 2002, American University
S	April 8, 2002, Massachusetts Metropolitan District Commission
T	April 8, 2002, Charles River Watershed Association
U	April 6, 2002, Emerald Necklace Conservancy
V	April 5, 2002, Brookline Town Meeting Members from Precinct One
W	April 8, 2002, Roger Frymire
X	April 8, 2002, Massachusetts Department of Environmental Protection
Y	April 8, 2002, Massachusetts Department of Environmental Management
Z	April 4, 2002, Town of Brookline, Massachusetts
AA	April 4, 2002, Massachusetts Emergency Management Agency
BB	April 8, 2002, United States Department of the Interior, National Park Service
CC	April 8, 2002 Massachusetts Historical Commission
DD	April 12, 2002 Massachusetts Historical Commission
EE	April 4, 2002, Town of Brookline Conservation Commission
FF	April 5, 2002, Friends of the Carlton Street Footbridge
GG	April 5, 2002, Town of Brookline Preservation Commission
HH	April 4, 2002, Brookline Village Action Groups
II	March 31, 2002, High Street Hill Association
JJ	April 4, 2002, Museum of Fine Arts, Boston
KK	April 8, 2002, The Fenway Alliance
LL	April 11, 2002, Boston Water and Sewer Commission
MM	April 9, 2002, YMCA of Greater Boston
NN	March 8, 2002, Charles Beveridge, Editor Frederick Law Olmstead Papers
OO	April 10, 2002, New England Conservatory
PP	April 9, 2002, Harvard School of Public Health

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
DEIR CERTIFICATE		
Wetlands		
A-1	The FEIR should contain sufficient details on the dredging and Phragmites removal components of the project to determine which aspects of such would be permittable under the WPA at the local level and which aspects would require a Variance.	See Section 4. The work is proposed as a limited project pursuant to 310 CMR 10.53(4) which allows projects to proceed that will improve the natural capacity of a resource area to protect the interests of the Act. In the event the issuing authority does not agree with the use of 10.53(4) for the in-stream basins, the basins would meet the variance standards
A-2	For the subareas where a Variance would be required, the FEIR should demonstrate how the project (both in the immediately affected subarea and as a whole) could meet the requirements set forth by DEP (particularly those relating to demonstration of an overriding public interest, infeasibility of alternatives, and development of mitigation) to obtain a Variance to the WPA.	The project as a whole and subareas, can meet the criteria for approval as a variance as set forth by the DEP including demonstration of an overriding public interest, infeasibility of alternatives, and development of mitigation. See Section 4 for discussion of this issue.
A-3	The Variance alternative analysis for the Back Bay Fens "over-dredging" should include any alternatives required by DEP, but the analysis must also include an alternative that relies on enhanced stormwater management/BMP implementation in the Muddy River watershed upstream of the Back Bay Fens. This analysis should have the effect of identifying additional maintenance and BMP measures that the proponent must implement in order to protect the substantial public investment in the project.	The only potential alternatives to over -dredging in the Back Bay Fens are construction of sedimentation basins or tanks along the river. A discussion of these alternative is presented in Section 4. A full discussion of the proposed stormwater management BMP program is presented in Section 5.
A-4	The FEIR should include more detail (both quantitative and qualitative) on alteration and replication of BVW, including identification of all areas that will experience permanent loss of BVW and all areas where BVW replication is proposed.	See Section 3 for a discussion of the extent of wetland loss and proposed replacement.
A-5	The FEIR should provide more detail on the specifics of the Phragmites removal and replication design.	See Section 3 for a discussion of *Phragmites* functions and values, removal, replication and design.
A-6	The FEIR should include analysis of whether any other invasive species (e.g. purple loosestrife, buckthorn) will be removed, and the proposed method of removal.	See Section 3. *Phragmites* growing in the river channel will be removed by mechanical means during dredging, or by the hydraulic dredge. Along the riverbanks, *Phragmites* and other invasives will be cut during the active growing season and a glyphosate based herbicide will be applied to the cut stalks.
Water Quality/Sediment Management		
A-7	The FEIR should include a much more detailed discussion of WQC issues, including a demonstration that the project meets the applicable performance standards in the WQC regulations.	See Section 4 for a detailed discussion of the project's ability to meet both the Wetlands Protection Act and 401 Water Quality Certification requirements.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
A-8	The FEIR should include an alternatives analysis demonstrating that the proposed "over-dredging" is the preferred alternative.	Over-dredging or dredging of in-stream basins is the only alternative to collect sediment conveyed to the river via point and non-point sources. See Section 4 for a discussion of this alternative.
A-9	The WQC alternatives analysis should include an enhanced stormwater mgt/BMP alternative in the upstream watershed, similar to the requirements discussed for the wetlands variance	See Sections 4 and 5. BMPs are proposed in the upstream watershed and are not an alternative to the in-stream sedimentation basins.
A-10	The FEIR should analyze the potential for anoxic conditions to develop in areas of over-dredging and potential impacts on water quality and benthic habitat.	Over-dredged areas will only be about 2 feet deeper than the surrounding river bottom. Water depths in over-dredged areas will be 8 to 10 feet deep, depending upon location. This shallow depth will remain well- mixed and result in stratification or the development of anoxic conditions. See Section 3 for a discussion of this issue.
A-11	The FEIR should analyze impacts from periodic maintenance dredging on water quality and benthic habitat	Periodic maintenance will result in fewer impacts than the proposed whole-scale projects. Please refer to Section 3 of this FEIR for additional information.
A-12	FEIR should address DEP concerns about proposed length of mixing zone and suspended solids limits for use in water quality monitoring.	Site specific mixing zones are calculated for each dredge discharge location. Please refer to Section 3 of this FEIR.
A-13	FEIR should include more discussion of construction-period water quality performance stds, and identify action thresholds and mgt responses if the monitoring plan reveals any problems.	See Section 10, and specifically Table 10-1, for a list of water quality performance standards. Monitoring and reporting will be used to determine what actions are needed to comply with standards.
A-14	FEIR should provide more details on dewatering process and sediment mgt in general	This information is provided in Section 2
A-15	FEIR should address DEP comments concerning sediment sampling and mgt protocols.	DEP's comments have been addressed in Section 2.
	Maintenance and Management	
A-16	Obtaining enforceable maintenance and mgt commitments is a necessary condition for the FEIR to be found adequate and for agencies to meet Section 61 obligations, as well as for receiving additional funds.	The proponents concur that maintenance and mgt are crucial to the long-term success of the project. See Section 6 for further discussion.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
A-17	Revise Maintenance Study from DEIR into a performance-based Maintenance and Mgt Action Plan in FEIR. Plan should specify mgt structure, staffing, eqpt, and procedures. Plans should establish measurable environmental performance stds for sediment removal, erosion control, water quality, wetland and upland plantings, fish and benthic resources, wildlife resources, culvert maintenance and structural source control and treatment control BMPs. Plan should present an acceptable strategy for closing the gap between person hours needed to maintain the project area and the hours currently available. Trained professional staff is essential to ensure that resources are managed and maintained appropriately.	See Section 6 for a detailed discussion of maintenance and management. Performance standards, and mitigation measures, are listed in Table 10-1.
A-18	FEIR should present preferred mgt structure and discuss reasons for its selection and should ensure that the mgt structure is compatible and consistent with requirements laid out in Cert and in the Charlesgate FROD	Section 6 addresses the FROD requirements. The preferred management structure is a Public/Private Partnership. The reason for its selection is discussed in Section 6.
A-19	More should be done to protect the public investment in the project through use of BMPs	A comprehensive BMP program is being designed for Phase I, to included increased frequency in source control measures such as street sweeping and catch basin cleaning, and evaluation and design of numerous structural BMPs throughout the watershed.
A-20	FEIR should include results of Charlesgate BMP work plan and should continue a BMP Plan for the Muddy River Watershed that identifies specific BMPs, includes a planning, permitting, and construction schedule, appropriate commitments to implement the plan, and dedicated funding sources.	Improvements in the Stony Brook Conduit will reduce frequency and volume of loading in the Charlesgate area of the river, as discussed in Section 5.3.3. The specific BMP plan, identifying specific structural BMPs is discussed in Section 5.4.
A-21	Encourage proponents to pursue a pilot BMP program as soon as possible	A pilot program on particle separators began in Fall 2002. As discussed in the DEIR, the pilot program involves collection of water quality and velocity data during storm events to help determine proper design and site selection of additional particle separators in the watershed.
A-22	1999 MOU concerning maintenance and mgt issues may need to be amended to include additional commitments by Brookline and Boston. Also provides an opportunity to more actively include MDC.	See Section 6 - Proponents will be amending both the MOU and MOA to reflect a new management structure and financing.
	Role of CAC	

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
A-23	CAC will continue to play an active role in advising MEPA and proponents throughout development of the FEIR and in preparation of Annual Updates. CAC will also provide advice to proponents as they undertake the BMP study to be included in the FEIR and will play a role in the independent oversight body.	See Section 6 for discussion of the CAC's role, which will be ongoing beyond project construction. The CAC will form part of the Environmental Improvements Committee.
	Historic Resources	
A-24	Consult with MHC on methods of avoiding, minimizing, or mitigating impacts. Also consult with MHC regarding alternatives under consideration for the Carlton Street Footbridge	See Section 7. There will be consultations with MHC when final design is underway.
A-25	Include more detail on measures to protect extant historic and cultural resources within the project area during construction and beyond, including protection of plantings, structures and other historic landscape features.	See Section 7 for a discussion of protection measures. There will be discussion with MHC during final design to ensure adequate protection is incorporated.
	Carlton Street Footbridge	
A-26	Carlton Street Footbridge is historically significant; Brookline must act in good faith to expeditiously implement the elements of the Master Plan within its control, including the rehabilitation and reopening of the footbridge.	See Section 7. Brookline is currently evaluating options for the bridge and there will be a vote of Town Meeting in Spring 2003.
A-27	Any change in Brookline's commitment to rehabilitate and reopen the footbridge will require, at a minimum, the filing of a NPC.	No response required.
	Back Bay Yard	
A-28	FEIR should include a determination of the property owner of dirt bike course site, and if Boson owns the property, should include appropriate plans to restore the landscape of the area (If MBTA is owner, proponents should work with MBTA to ensure rehabilitation of the area).	See Section 8. The area is owned primarily by the MBTA and partially by the City of Boston. Because the dirt bike activities do not currently pose a threat to river water quality, there area no plans to restore the area. Monitoring of the area will occur.
	Rare Species	
A-29	FEIR should address the ability of the preferred alternative to meet WPA performance stds for rare species, using MNHESP list of additional information requirements. Should provide level of details appropriate for MEPA review and of sufficient detail to determine whether impacts would be permittable under the WPA at the local level, or would require a variance.	See Section 9. The proposed project will have no adverse effect on rare species; therefore, no variance should be required. Ability of the project to meet the variance provisions is nonetheless presented.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
A-30	If a variance is needed, FEIR should demonstrate how the project (both in Spring Pond/Willow Pond area and as a whole) could meet the requirements set forth by DEP to obtain a variance	See Section 9 and response to A-29.
	Annual Updates	
A-31	Annual Updates should include mileposts to measure attainment of environmental goals and adherence to performance stds; summary and analysis of reports listed on page 31 of Executive Summary; summary of funds expended on implementation of the project by category; budget and funding sources for the upcoming year; summary of monitoring information on current environmental conditions; copies of Army Corps annual inspection report and Charlesgate annual inspection report, and discussion of actions taken to address issues	See Section 6. An outline of the Annual Update is presented along with discussion of reporting mechanisms.
	Comments	
A-32	FEIR should contain copies of comment letters and address issues raised therein	See Appendix A for copies of letters.
	Mitigation/Section 61 Findings	
A-33	FEIR should include Proposed Section 61 Findings identifying specific mitigation measures and parties responsible for funding and implementation, as well as a detailed implementation schedule. Findings will need to include more than generic references to maintenance and mgt responsibilities. Findings should also incorporate the specific comments on mitigation made by the permitting agencies, in particular DEP.	See Section 10 for Section 61 findings (Table 10-1 lists mitigation measures/performance stds). Also see Section 6 for maintenance/management responsibilities.
	LETTER B - DIVISION OF FISHERIES AND WILDLIFE, NATURAL HERITAGE & ENDANGERED SPECIES PROGRAM	
B-1	The Natural Heritage & Endangered Species Program will provide comments to the proponent during the Wetlands Protection Act process when plan details are provided	Information will be provided during the NOI process as requested.
	LETTER C - EDWARD B. CUTLER, PhD, 14 MONMOUTH COURT, BROOKLINE, MA 02446 (CAC MEMBER)	
C-1	Examine any and all methods for making the park accessible for the mobility impaired, particularly from Brookline, and develop an access upgrade plan before final approval. The development of this plan would hopefully include the MBTA and the MDC as well as the City of Boston and Town of Brookline.	Handicap accessibility is an issue to be addressed in the Master Plan for the park. The Phase I Muddy River project does not impact areas requiring handicap access.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
LETTER D - MASSACHUSETTS DIVISION OF MARINE FISHERIES		
	In support of the project.	No response required.
LETTER E - LISA TUCKER-KELLOGG, 12 MONMOUTH COURT, BROOKLINE, MA 02246-5634		
E-1	Addresses concern about wheelchair access to the park. The existing Riverway park entrance at the Longwood MBTA stop is not wheelchair accessible.	See response to C-1.
LETTER F - BROOKLINE DPW		
F-1	Brookline DPW would like clarification from MEPA on what is meant by "substantial mitigation," whether by example, definition or dollar sum, as stated in a letter dated 9/27/01 from MEPA to two Brookline residents (Mr. Cutler and Mr. Mattison) regarding Carlton Street Footbridge.	No proponent response required.
LETTER G - BROOKLINE GREENSPACE ALLIANCE		
G-1	Planned improvements to the system cannot be accomplished as long MHD fails to sweep and clean catch basins along Rte 9 (Boylston St.) in Brookline.	Under EPA's and DEP's Phase II Stormwater Permitting Program, MHD is considering a "non-traditional" Municipal Separate Storm Sewer System, and is required to submit a Stormwater Management Plan in March 2003 showing how it will meet six minimum control measures. EPA and DEP are expected to require MHD to conduct rigorous street sweeping and catch basin cleaning programs
G-2	Brookline needs to budget a suitable amount to cover its share of the Phase 1 restoration	Brookline has submitted a letter of funding commitment to MEPA as part of the Record of Decision.
G-3	Willow Pond requires cleaning. Its status is the result of old leaks at the now Brookline's DPW facility on Cypress Street and the cleaning should be Brookline's responsibility.	Brookline has dealt with the DPW release separately from the Muddy River project. The proposed dredging on this project will remove the contaminated sediments from Willow Pond.
G-4	Wildlife habitat must be addressed in the FEIR unless it's a Phase 2 target, if so, that should be made clear.	See Sections 3 and 9 for a discussion of wildlife habitat. Habitat restoration is a goal of this project.
G-5	Non-native invasive animals, specifically geese, should be addressed, even if postponed to Phase 2.	A waterfowl control program will be developed by both the City of Boston and the Town of Brookline in late 2002 or early 2003, as discussed in the Draft EIR, to include plantings to keep waterfowl from the water's edge and signage to prevent feeding of waterfowl.
G-6	Give greater sense of urgency to flooding issues.	Flood control is one of the primary objectives of the overall project.

CODE	SUMMARY	RESPONSE
G-7	There should be identifiable budget items for maintenance of the restored waterway in the budgets of Boston, Brookline, MHD, and the MDC.	Estimated expenses are in Section 6, the particular form these budgets take in the municipal budgets will be up to the budget directors.
G-8	There should be a continuing CAC, with organizational seats, and the Brookline Greenspace Alliance should have one of the longer-term seats.	See Section 6 for a discussion of roles and responsibilities. The CAC will be represented on the Environmental Improvements Committee, as will the Brookline Greenspace Alliance.
G-9	Restore banks of the small islands on the west shore of Leverett Pond.	The banks of Leverett Pond and its islands will be restored.
LETTER H - NORTHEASTERN UNIVERSITY		
H-1	In support of the project.	No response required.
LETTER I - MASCO		
I-1	Consideration should be given to alternative truck access routes to and from staging areas in the Fenway section.	The development of the truck routes shown in the DEIR involved balancing concerns of truck traffic impacts through residential areas, on congested routes, or on routes that could not physically accommodate the truck turning maneuvers. Because truck origins and destinations are not currently known, the routes were intended to represent a planning-level assessment of how to best link the staging areas with the regional roadway network. Therefore, the defined routes in the DEIR can be subject to modification as the project progresses. The project proponent will work closely with MASCO if there is a desire to alter any designated truck routes as the project progresses. In final design when the construction sequencing and scheduling is established, the proponents will coordinate the specific truck routes with the appropriate parties, including BTD, Town of Brookline, MDC, MASCO and other entities proposing construction in the vicinity of the project. This coordination will continue through construction.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
		The suggestion that all trucks approach the three Fenway staging areas via Massachusetts Avenue to Bolyston Street to Ipswich Street to Park Drive would result in an illegal left-turn from Massachusetts Avenue onto Boylston Street. This left-turn is currently prohibited to prevent disrupting traffic flow on Massachusetts Avenue. The suggestion that all trucks leave the Lagoon and Fens Bridge staging areas via Park Drive to Boylston Street to Fenway to Westland Street would result in trucks making a right turn from Park Drive onto Boylston Street that has a tight turn radius and a very active street corner. This movement was not viewed favorably during the development of the truck routes through the Fenway because of concerns that larger trucks may not be able to make the right-turn without encroaching on the street corner or the opposing traffic lanes.
I-2	Show what the traffic impacts are likely to be instead of the "worst case" scenario.	The trip generation estimate was a conservative estimate and is based on assumed levels of productivity for the project. During the morning and evening peak traffic demand periods, any traffic impacts for the project would be mainly attributable to temporary lane closures or roadway closures rather than additional truck traffic. Therefore, changing the trip generation estimate from the "worst case" scenario that is provided in the DEIR would not change conclusions made regarding the impact of lane closures through the former Sears Rotary or the impact of temporarily closing Netherlands Road.
I-3	Address inconsistencies regarding traffic plans during culvert construction at the Riverway/Park Drive (Fenway)	The traffic volume at the Riverway / Park Drive culvert can be supported with a single lane closure. We are allowing a closure if sufficient information is provided in the Traffic Management plan required from the Contractor.
I-4	Address inconsistency regarding culvert construction at Brookline Avenue	The proposal is not to close any lanes other than at night for the Brookline Avenue culvert. It was not meant to imply a lane closure.
I-5	No consideration should be given to elimination of the jughandle east of Brookline Ave. in the absence of commitments to the associated Riverway/Park Drive intersection improvements.	Elimination of the jug handle is not under consideration in this project unless other agencies make this commitment based on overall traffic improvements to this area. If the jug handle is eliminated, then an extended daylighting should be considered.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
I-6	The impacts that closing Netherlands Road will have on the adjacent Riverway/Brookline Ave. and Brookline/Francis intersection(s) are unacceptable and proposed mitigation is insufficient.	If necessary, the project proponent will work with the MDC, the City of Boston, the Town of Brookline, and MASCO planners to develop appropriate mitigation for the project at the intersection of Brookline Avenue and the Riverway. Because the project's impacts to this intersection is a temporary condition lasting about 6 months, major infrastructure work or the creation of additional lanes was not proposed in the DEIR. Rather, improved lane markings and signal adjustments were proposed so that the once Netherlands Road reopens, the intersection geometry could be returned to pre-construction conditions. As added construction mitigation, the project proponent will work with area planners to schedule the closure of Netherlands Road so that it would occur mostly during the summer when traffic in the area is typically lower than other times of the year.
I-7	More clarity in the FEIR needed related to construction sequencing and the time that the Fens, Sears Rotary, and Netherlands Road staging areas will be occupied by construction.	There can be no more detail added to the construction phasing until the Army Corps of Engineers involvement is finalized since their funding will govern how the project will ultimately be phased.
I-8	Encourage the selected contractor to work closely with the MASCO construction coordinator, beyond the Public Meetings.	Comment accepted.
I-9	Alternatives to the Netherlands Road staging area are suggested.	As added construction mitigation at the intersection of Brookline Avenue and the Riverway associated with the temporary closure of Netherlands Road, the project proponent will work with the MDC, the City of Boston, the Town of Brookline, and MASCO planners to schedule the road closure so that it would occur mostly in the summer when traffic in the area is typically lower than other times of the year. If necessary, the project proponent will develop other appropriate mitigation for the project at the intersection of Brookline Avenue and the Riverway.
I-10	Break down the project into phasable pieces if significant funding is not forthcoming.	The project may not be financially feasible in segments if significant federal funding is not available. A Notice of Project Change would be submitted in the event of a major change in the implementation schedule.
I-11	In accord with CAC comments, resolutions should be adopted by the executive and legislative branches to fund the Muddy River Project	Proponents are working with legislative and executive branches to provide funding for the project.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
I-12	FEIR should include in the long-term management plan a person or entity that can see the "whole picture."	See Section 6 for a discussion of management structure, which is proposed as a Public/Private Partnership with an independent Environmental Improvements Committee to provide a forum for discussion of all project elements.
I-13	FEIR should resolve MDC's role in maintaining the parkway and funding for maintenance.	See Section 6. The proponents and the MDC have met several times to begin crafting an agreement to include the MDC in the management and maintenance planning of the project.
I-14	FEIR should explain why the Charles River Dam is not included in the Emergency Action Plan for flooding and explain communication systems of the plan.	The plan does include contact individuals for each agency. The MDC action plan includes operation of the Charles River Dam. The plan has successfully operated in several storms since it was formulated and the DEIR only describes the plan negotiated by others.
I-15	MASCO willing to discuss resident parking in designated parking lots during street sweeping.	MASCO's willingness to discuss this issue is welcome. It can only improve the effectiveness of street sweeping programs
I-16	City Department or Agency should be responsible for cleaning MDC catch basins on a regular basis.	The MDC will retain responsibility for cleaning MDC catch basins.
I-17	Acc. Volume 1, Fig. 6-15...after the dredging will we still experience flooding in buildings that have not been waterproofed?	Project will significantly lower flood levels but can not further lower the flooding level without significantly more cost. The hydraulic gradients in this system are so flat that further reduction in levels is very difficult to achieve. Storms with greater flood potential that the October 1996 storm would still cause flooding but at much reduced levels.
I-18	Clarify Brookline Avenue water main crossing and condition of pipes.	A decision on the alternative water main crossing would be made during design. The proposals in the DEIR indicate there are feasible alternatives to relocating the major water main. At this point the continued use of the 7 x 9 foot drain well into the future considering its age is probably not prudent. As far as we know it is not in imminent danger of collapse.
I-19	Odors may affect hospitals, colleges and residences in LMA.	See Section 10 for mitigation measures. In the Charlesgate area odors were not a problem and provisions for odor control are included
I-20	Volume 1, p. 4-80, MASCO has observed additional wildlife in the Riverway.	The listing of wildlife was never intended to be a comprehensive inventory of species. Rather, it was intended to characterize the types of species present and thereby characterize the nature of the habitats present.
I-21	Volume 1, p. 5-17. Where will the 24-inch sewer under the daylighted section of the Sears lot be relocated to?	The need to relocate the 24-inch sewer will be investigated during final design. If relocation is needed, it will be adjacent to its current location. In any case, the design will accommodate the maintenance of sewer flows throughout the construction period.
I-22	Please use correct terminology in the FEIR (Longwood Medical and Academic Area - LMA) and correct geography (the LMA abuts what is called the Back Bay Fens)	Comment acknowledged.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
I-24	Volume 5, Appendix F, Figures F3-2 through F3-6, difficult to determine the difference in shadings between sediment going to an unlined in-state, out-of-state or RCRA landfill.	Color figures F3-1 through F3-6 are legible.
	LETTER J - FRIENDS OF THE MUDDY RIVER	
J-1	Governmental authorities in Brookline and Boston should declare dumping in catch basins unacceptable, fine those who dump.	Dumping in catch basins is illegal and subject to fines. For example, Boston Water and Sewer Commissions' Sewer Use Regulations Article V, Section 1, prohibit dumping materials to catch basins. Enforcement and fines are outlined in Article VII. The current fine for dumping to a catch basin is $5000 per occurrence.
J-2	Section 4 (Existing Conditions) has a truncated and inaccurate list of birds on the Riverway	See response to I-20 above
J-3	The inventory of trees suggests that some Heritage trees on the Riverway should be harvested despite the effort to protect all Heritage trees.	See Section 7. There are no plans to harvest Heritage trees.
J-4	Special provisions should be provided for oversight of shrub plantings to ensure survival	New plantings will be inspected beyond the construction period as described in Section 6.
J-5	Planning for Riverway design should consider park as currently exists.	The project is consistent with the Emerald Necklace Master Plan and includes elements that are rehabilitation and some restoration where feasible. See DEIR Section 2.4.
J-6	Water quality testing should include testing for oil and grease.	Oil and grease are not regulated parameters, but we have included total petroleum hydrocarbons (TPH) in the monitoring plan. TPH is an indicator of oil and grease.
	LETTER K - FRANCES SHEDD-FISHER	
K-1	MEPA should make legal requirements for municipalities, affected educational and cultural institutions and long-term standard of maintenance that protects the investment.	No response required.
	LETTER L - ARLEYN LEVEE	
L-1	The entire resource should be considered foremost according to the appropriate historic preservation standards, regarding all proposed work as an interrelated system	See Section 7. Preservation and restoration of historic integrity is a critical project objective.
L-2	Strong commitments should be in place to ensure that with approval of the Charlesgate project the rest of the project will proceed.	No response required.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
L-3	Boston, Brookline, MDC, and the state should fund and develop innovative stewardship programs as part of BMPs recommended by the CAC.	See Sections 5 and 6 for a discussion of BMPs and maintenance requirements, respectively.
LETTER M - FENWAY STUDIOS, INC.		
M-1	Why is MDC not a project proponent?	See Section 6. The proponents and the MDC have met several times to begin crafting an agreement to include the MDC in the management and maintenance planning of the project.
M-2	MDC should fund the parts of the Emerald Necklace and Muddy River Projects that is within their jurisdiction.	See Section 6 and response to M-1.
M-3	[The FEIR] should include specifics about how the municipalities will share cost of maintenance and management. MDC should be included, possibly entering into a MOU.	See Section 6 and response to M-1.
M-4	[The FEIR] should fully develop one of the additionally listed management structure alternatives, other than "status quo," or some hitherto undefined alternative. Proponents should work with the Emerald Necklace Conservancy.	See Section 6 for a discussion of the management structure, which includes a proposed Public/Private Partnership with the ENC as the private partner.
M-5	[The FEIR] should provide details of the maintenance plan.	See Section 6 for a detailed discussion of maintenance and management. Performance standards, and mitigation measures, are listed in Table 10-1.
M-6	Proponents, the MDC, and other property owners abutting the park should fund and carry out the BMPs.	The proponents concur. See Section 6 for further discussion of maintenance and funding responsibilities.
M-7	Enforced car towing program needed in order for street sweeping to be successful. Require the proponents, in particular the MDC, to reset and repair curbs throughout the system to stop sediments from reaching the river. Implement BMPs immediately to the extent possible.	The DEIR calls for enforced car towing. In Brookline, car towing is common during periods when overnight parking is banned, regardless of street sweeping practices. Towing specifically to enhance street sweeping is seldom needed. Boston has taken an increasingly aggressive approach regarding car towing, and enforcement is expected to continue. See Section 5.1.4 and Section 6 for information on repairing and re-setting curbs and related drainage improvements. Non-structural and some structural BMPs are already in place. Enhancements to non-structural BMPs and construction of some structural BMPs will take place according to a defined schedule.
M-8	City of Boston should remove the "jug handle", mandate daylighting of river in this area.	See response to I-5 above.
M-9	The project should not be modified to change the character of the rehabilitation as described in the DEIR. Culverts should be arched, historic headwalls restored, and channel should follow historic alignment.	No response required.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
M-10	The Charlesgate Parks rehabilitation should be an open public process (structured design forum). In-kind replacement of existing features is unacceptable.	No response required.
M-11	Create a safe and suitable pedestrian and bicyclists connection between the Charles River park system and the Emerald Necklace park system.	The project element is not part of the Phase I Muddy River Project but should be addressed as part of the Master Plan. However, studies by others are investigating a link between the Charles River Esplanade and Charlesgate.
LETTER N - BOSTON GREENSPACE ALLIANCE		
N-1	Require proponents and owners to come to an agreement in a timely manner on the development of a joint management and maintenance plan.	See Section 6 for a discussion of the management structure, which includes a proposed Public/Private Partnership with the ENC as the private partner.
N-2	The public commitments of the proponents with regards to management structure should be documented.	See response to N-1.
N-3	Create an independent oversight committee to monitor the commitments (like the Central Artery Oversight Committee).	See Section 6 for a discussion of management structure, which is proposed as a Public/Private Partnership with an independent Environmental Improvements Committee to provide a forum for discussion of all project elements.
N-4	[The FEIR] should identify the commitments of the municipalities and owners and their allocation of funding for the project.	See Section 6 and Final Record of Decision in Appendix B.
N-5	Allow Charlesgate project to proceed but not without commitments to the project as a whole.	Secretary approved proponents commitments in FROD and allowed permitting.
N-6	Maintain clear and consistent emphasis throughout the document on all 5 project objectives	The proponents concur and believe the Final EIR meets this goal.
N-7	The Emerald Necklace must be discussed as a historic park system that is an important component within the citywide system.	The proponents concur and believe the Final EIR meets this goal.
N-8	Respond to the priorities of the Emerald Necklace Master Plan	The proponents concur and believe the Final EIR meets this goal.
N-9	Reference opportunities surrounding the BU's proposed sailing pavilion and potential pedestrian access to the Esplanade	The project element is not part of the Phase I Muddy River Project but should be addressed as part of the Master Plan. However, studies by others are investigating a link between the Charles River Esplanade and Charlesgate.
N-10	Further develop the management and maintenance needs commitments	See Section 6 for a discussion of management structure, which is proposed as a Public/Private Partnership with an independent Environmental Improvements Committee to provide a forum for discussion of all project elements.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
N-11	[The FEIR] must prioritize use of staff with specialized skills vs. volunteers.	See Section 6 for a discussion of management structure, which is proposed as a Public/Private Partnership with an independent Environmental Improvements Committee to provide a forum for discussion of all project elements.
N-12	Clear measurable objectives and a mechanism for oversight must be part of the maintenance program. Same standards should be applied to Boston and Brookline.	See Section 6 for a discussion of management structure, which is proposed as a Public/Private Partnership with an independent Environmental Improvements Committee to provide a forum for discussion of all project elements.
N-13	MDC's role and commitment to the project as an owner should be clarified.	See Section 6. The proponents and the MDC have met several times to begin crafting an agreement to include the MDC in the management and maintenance planning of the project.
N-14	If proponents agree that level of maintenance described in the DEIR is appropriate then they should be required to develop dedicated funding streams.	See Section 6 concerning the renegotiated MOU and MOA.
N-15	Annual Updates should look at past performance as well as future objectives and be reviewed by an independent oversight committee.	See Section 6 for an outline and discussion of the Annual Update contents.
N-16	The CAC should continue for the entirety of the project.	See Section 6. The CAC will continue to provide input through review of the Annual Updates.
LETTER O - EMERALD NECKLACE CITIZENS ADVISORY COMMITTEE (CAC)		
O-1	[The FEIR] should provide details on the proponents joint maintenance and management plan and their share of future maintenance and management costs	See Section 6 for discussion of management structure and estimate of funding shares for maintenance.
O-2	Mitigation outlined in the DEIR will minimize environmental impacts but needs to be carefully implemented and monitored beyond the construction phases of the project.	The proponents concur. See Sections 6 and 10 for a discussion of mitigation and monitoring beyond construction.
O-3	[The FEIR] should describe a cross-jurisdictional management structure, including timetable for implementation.	See Section 6 for a discussion of management structure, which is proposed as a Public/Private Partnership with an independent Environmental Improvements Committee to provide a forum for discussion of all project elements.
O-4	[The FEIR] should include an overall maintenance coordinator.	See Section 6 concerning the management structure selected for the project and future maintenance.
O-5	[The FEIR] should provide a detailed plan to improve maintenance operations for the park system to meet the objectives outlined in the ETM Maintenance Plan. Higher maintenance stds should be consistently applied across all jurisdictions and techniques used should be specific to each particular type of parkland.	See Section 6. The maintenance plan presented in the Draft EIR has been updated and addresses achievement of higher maintenance standards.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
O-6	The 5 objectives should be given equal emphasis. [The FEIR] should correct contradictory statements, omissions, and inconsistent references to Historic Preservation	The project is technically an historic rehabilitation.
O-7	Concerned about the proponents' ability to maintain a continued financial commitment to the project. CAC will assist in securing necessary funding.	See Section 6 concerning the renegotiated MOU and MOA.
O-8	[The FEIR] should show that proponent's financial commitments will be secured. ENC should be invited to participate in developing funding strategy.	See Section 6 concerning the renegotiated MOU and MOA.
O-9	MDC should fund park maintenance and stormwater BMPs within its jurisdiction.	See Section 6. The proponents and the MDC have met several times to begin crafting an agreement to include the MDC in the management and maintenance planning of the project.
O-10	Boston, Brookline, and MDC need increased maintenance funding.	See Section 6 for an updated maintenance estimate.
O-11	Implementation of BMPs is crucial to the success of the project.	A comprehensive BMP program is being designed for Phase I, to include increased frequency in source control measures such as street sweeping and catch basin cleaning, and evaluation and design of numerous structural BMPs throughout the watershed.
O-12	[The FEIR] should require regular monitoring reports from the proponents and MDC to monitor progress in implementing BMPs.	Regular monitoring reports to monitor progress in implementing BMPs will be provided in the Annual Update to the Secretary, as discussed in Section 5.6.
O-13	Street sweeping should be accompanied by a towing program	In Brookline, car towing is common during periods when overnight parking is banned, regardless of street sweeping practices. Towing specifically to enhance street sweeping is seldom needed. Boston has taken an increasingly aggressive approach regarding car towing, and enforcement is expected to continue. The MDC employs towing when street sweeping is performed.
O-14	Reduce storm drain dumping through public education, signage, and enforcement.	Storm drain dumping is addressed as a basin wide source control BMP in the DEIR.
O-15	Control Canada goose population	A plan for the waterfowl control program will be developed by both the City of Boston and the Town of Brookline by 2003. Plantings to keep waterfowl from the water's edge would be included in the construction program and signage to prevent feeding of waterfowl would be provided by the proponents.
O-16	Collect trash and yard waste at the Victory Gardens	See Section 6 and Appendices for the maintenance plan that includes trash collection.
O-17	Repair/reset curbs.	Reconstruction, monitoring and maintenance of the curbing and storm water drainage along MDC roadways in the Fens and the Riverway is recommended, as discussed in Section 5.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
O-18	Consider alternative location, such as Millennium Park, for Daisy Field staging area if softball will be disrupted for more than one season, to reduce erosion into adjacent waterway	Millennium Park is not close to the project area. BPRD will be consulted for staging area disruption and erosion control will be provided. Relocation of one of the ballfields from Daisy Field to Millennium Park was discussed with the user groups and rejected. The Daisy Field users are mostly neighborhood youth soccer and baseball organizations whose members come from nearby Jamaica Plain.
O-19	Maintain permanent record accessible to proponents and CAC of BMP activity including catchbasin cleaning and dredging.	Catch basin cleaning information is available from BWSC, MDC and the Brookline Department of Public Works and will be summarized in the Annual Updates. Status of dredge maintenance is included in the Annual Update Report.
O-20	Consider cisterns or other methods to reuse stormwater runoff to reduce irrigation.	Cisterns are not a viable option due to the large number of cisterns necessary to have even a small impact on reducing runoff. Nevertheless, BWSC does require onsite stormwater reuse or infiltration to the extent practical when a landowner is seeking a BWSC connection or other permit.
O-21	Apply consistent standards for street-sweeping and catch basin cleaning.	While there are consistent minimum standards for street sweeping and catch basin cleaning, Brookline as taken a very aggressive approach to these BMPs that exceed the minimum standards.
O-22	BMPs should be implemented during, or even before, construction.	The pilot program on BMPs began in Fall 2002. Results of the pilot program are necessary to ensure proper siting and design of any additional particle separators, which comprise a large portion of recommended structural BMPs. Source control BMPs are already in place in the watershed, and the project proponents have continuously been working to increase frequency and effectiveness of these measures since the initial filing of the DEIR. BWSC is requiring BMPs at all new developments, such as Emmanuel College. BMPs are being installed on privately owned sites within the Muddy River watershed. The Town of Brookline is proposing to adopt similar regulations.
O-23	[The FEIR] should discuss the culvert headwall at Leverett Pond as part of infrastructure needs in Boston.	In the opinion of the proponents and their consultant, this is not currently required.
O-24	City of Boston needs to make a decision on the removal of the "jug handle" before construction begins so that daylighting and historic shoreline alignments can be coordinated.	See response to I-5 above.
O-25	The project should not be modified to change the character of the rehabilitation as described in the DEIR. Culverts should be arched, historic headwalls restored, and channel should follow historic alignment.	No response required.
O-26	Having an Environmental Monitor during construction is vital.	We concur. An Environmental Monitor is included in the Charlesgate work and we intend to include one in future contracts.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
O-27	Signage describing the project should be placed at each construction staging area.	Signage is included in the Charlesgate specifications and the proponents intend to include it in future contracts.
O-28	All work should stop no later than 11:00 pm	Construction of the culvert at Brookline Avenue is likely to require two-shift construction. Drilled piles will be the preferred support method and steel sheeting would only be driven until 11 p.m. The contractor would have to meet Boston and Brookline noise regulations at all times.
O-29	Include Transportation Management Plan in construction documents.	The contractor will be required to prepare a Traffic Management Plan incorporating specific requirements.
O-30	[The FEIR] should address public health risks associated with flooding	Reduction of the flood impacts by dredging and constructing new infrastructure improves all impacts due to flooding including health impacts if any.
O-31	[The FEIR] should provide more data on in-stream sedimentation basins and their water quality. Analysis should include future dredging, frequency, and cost effectiveness.	Additional information on the in-stream basins is presented in Section 3 and 4 of this FEIR. Section 3 presents additional information on the sediment quality, water quality, benthic organisms and periodic maintenance. Cost effectiveness is presented in Section 4 of this FEIR.
O-32	[The FEIR] should address other BMP structures such as infiltration devices and cisterns.	Various structural BMP, including sand filters, bioretention, and particle separators were evaluated for feasibility in the watershed as discussed in Section 5.4.
O-33	[The FEIR] should address the relocation of wildlife during dredging and construction..discuss with MA Div. Fish & Wildlife, MA Audubon, NE Aquarium.	The contractor will be required to hire a wildlife biologist who will relocate some species before construction and replace them after construction. A plan for preservation of the Threespine Stickleback is presented in Section 9.
O-34	[The FEIR] should include an outline and timetable for a structured public process to determine the rehabilitation of the Charlesgate parks.	No response required.
O-35	[The FEIR] should address the improvement of the pedestrian access across Willow Pond..in the area disturbed as a staging area..	There is no staging area at Willow Pond. Construction, dredging and landscaping will disturb the area but it will be returned to its original condition.
O-36	[The FEIR] should provide specific site improvements at Daisy Field.	As described in the DEIR, the staging area will be rehabilitated after dredging. Existing trees to remain will be protected and pruned, existing paths will be rehabilitated, existing lawn areas will be restored and the existing ball field complete with lighting, backstop, seating and fencing will be re-oriented in conformance with the 1990 Emerald Necklace Master Plan.
O-37	[The FEIR] executive summary should provide an effective tool for educating the public about the project.	Comment acknowledged.
O-38	[The FEIR] needs to clarify the appropriate period for the contractor's guarantee of new plants, when inspections of new plantings should begin, and frequency of inspections for status of invasive species.	The DEIR proposes a 2-year guarantee period at the end of which a landscape architect accepts material or requires additional replacements. Maintenance to address invasive species is included in Section 6.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
O-39	Eroding shorelines of Leverett Pond should be stabilized as a BMP.	Section 5 of the DEIR indicates that sections of the shore will be stabilized as part of the project.
O-40	CAC recommends that CAC's role be continued at least through completion of Phase 1.	The CAC is included in review of annual updates beyond the end of Phase I.
O-41	[The FEIR] should address detailed information on funding strategy for the project, consistent with the MOU.	Funding commitments were made as part of the FROD and the MOU and MOA are to be renegotiated as noted in Section 6.
LETTER P - CITY OF BOSTON, THE ENVIRONMENT DEPARTMENT		
P-1	[The FEIR] should include the ACOE draft decision.	The ACOE draft decision is not public so it can not be used yet.
P-2	We request that "Don't Dump - Drains to Boston Harbor" be installed at all project storm drains.	Each entity has specific guidelines by which catch basin plaques or stencils are placed. BWSC requires "Don't Dump" plaques on all new or rehabilitate catch basins while Brookline appropriates funds annually for a program by which volunteers stencil catch basins. Any new catch basin installed by this project in Boston will include a BWSC plaque. (Please note that the correct watershed for the BWSC plaques is the Charles River - not Boston Harbor.)
P-3	Consider using pervious materials for new and reconstructed sidewalks.	This would be the subject of a standards agreement between the proponents since the proponents currently have different standards.
P-4	Avoid above-ground structures associated with particle separators and other mechanical systems. Addition of any structure must be approved by Boston Landmarks Commission.	Particle separators being evaluated as part of the BMP program would be located entirely below ground. Any additional structural BMPs sited for the Muddy River will follow guidelines of the Boston Landmarks Commission. As described in Section 5, most structural BMPs will be upstream in the watershed, not in the historic parklands.
P-5	[The FEIR] should clarify the status of the project-area historic resources listed in Volume 1, Section 4, Table 4-1 by identifying the designation of each resource.	The status of historic resources will be reviewed with MHC prior to construction, as will final design plans.
P-6	All construction contracts should include that if excavation for culvert construction uncovers drainage structures or other features original to Olmsted design the City Archaeologist, Ellen Berkland, 617-635-3850 should be contacted.	Comment noted.
P-7	During construction, trucks should be prohibited from accessing Park Drive via Jersey Street to access the Lagoon area of the Back Bay fens	Planned truck routes noted in DEIR do not include Jersey Street. This provision will be included in the construction documents.
P-8	[The FEIR] should detail the way in which the use of all truck routes will be enforced and outline a plan for notifying residents and businesses.	The contractor will submit a Traffic Management Plan to be approved before construction as noted in Section 6. A public meeting is expected to be held before construction begins to inform local residents such as was done for Charlesgate.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
P-9	[The FEIR] should address prevention of materials being deposited on City streets and entering the stormwater system (wheel washes, 1-2" of gravel not less than 10 ft. in length, daily inspections, vacuum sweeping).	Wheel washes are included in the Charlesgate specifications and will be included in subsequent contracts.
P-10	Contact Steven G. Lipman of DEP to discuss Clean Air Construction Initiative use to minimize adverse construction project impacts.	This initiative has been included in the Charlesgate specifications and will be included in subsequent contracts. For the Charlesgate contract, the contractor certified that all onsite diesel powered equipment has been fitted with after-engine emission controls. Low sulfur diesel fuel is also being used in the same equipment.
P-11	Construction contracts should require implementation of noise and vibration reduction measures.	Noise control is part of the Dredged Material Management Plan. Vibration is included in this plan (to be prepared by the contractor). To control vibration, drilled piles are recommended.
P-12	During construction, no sound generating activity can be allowed before 7am and after 6pm. The Boston APCC should be notified each time a permit is sought from the Commissioner of the Inspectional Service Dept. to work outside of these limits.	A permit will be requested for any night work.
P-13	[The FEIR] should for the Brookline Ave. culvert construction identify the duration of night work, proximity to residences incl. dormitories, outer limits of nighttime work, expected sound level, mitigation measures, resident notifications, and process for filing complaints.	The actual duration will be dependent on the specific design selected for this work and will be the subject of additional CAC meetings. The sound levels will meet Boston's regulations concerning sound. The BPRD has a permanent telephone number for registering complaints concerning the park area. This phone number was used during the Charlesgate construction.
P-14	[The FEIR] should identify the potential for construction-related vibration impacts on structures, monitoring, and mitigation.	This is part of the design for Brookline Avenue.
P-15	Implement Transportation Demand Management (TDM) for construction workers.	This is part of the mitigation as described in the DEIR pg. 7-22
LETTER Q - BIKE BOSTON'S EMERALD NECKLACE GREENWAY PROJECT		
Q-1	Create path on MDC land adjacent to Storrow Drive to connect Beacon St. at Charlesgate to the Mass. Ave. bridge at Charles River.	This is not part of the project area.
Q-2	Permanently close Netherlands Road through the park.	This is a decision that would need to be made by Brookline. The project only proposes to temporarily close Netherlands Road and return it to current use once the staging area is not needed.
Q-3	Create dual path at the Northeast end of Leverett Pond from Rte. 9 to first dirt path.	This element is not part of the Phase I Muddy River project. It needs to be addressed through the Emerald Necklace Master Plan.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
Q-4	New bicycle paths by former Sears building must have safe connections between the Riverway Park paths and the Back Bay Fens paths. Install traffic signals at Riverway, Brookline Ave., and the Fens bridge.	This element is not part of the Phase I Muddy River project. It needs to be addressed through the Emerald Necklace Master Plan.
Q-5	Street sweep new bike lanes on Perkins Street.	The MDC maintains Perkins Street and will evaluate street sweeping of bike lanes as part of their street sweeping program.
Q-6	There must be one continuous connecting paved path for bicycles and skaters. A parallel walking path may be unpaved but designed not to erode.	This element is not part of the Phase I Muddy River project. It needs to be addressed through the Emerald Necklace Master Plan.
Q-7	Construction staging areas should not interrupt bike paths.	Where construction staging areas interrupt existing pathways, temporary pathways are to be constructed by the contractor.
Q-8	Fencing/haybales should be installed 2 ft away from bike paths.	Comment noted.
	LETTER R - AMERICAN UNIVERSITY	
R-1	In support of the project.	No response required.
	LETTER S - MDC	
S-1	MDC wants to be part of management structure to implement maintenance plan and will work with proponents and env. agencies to make commitments.	See Section 6. The proponents and the MDC have met several times to begin crafting an agreement to include the MDC in the management and maintenance planning of the project.
	LETTER T - CHARLES RIVER WATERSHED ASSOCIATION (CRWA)	
T-1	[The FEIR] should include detailed measures for bank-to-bank dredging to prevent sediment transport; silt curtains alone are not effective. Breaches during wet weather and turbidity from belt filter pressate are also concerns.	For Charlesgate, DEP's WQC required silt curtains with oil-absorbent booms. These have provided effective control for the parameters identified in the WQC. DEP has not suggested that control of organics is an issue. The contractor's stormwater plan will have to address how operations will be carried out during storms, including how to repair breaches. The WQC requirements must be met at all times, regardless of the weather.
T-2	[The FEIR] should include a comprehensive plan for water quality sampling and monitoring during dredging operations.	Sampling and monitoring will be conducted as described in Section 2. The requirements will be dictated by the Water Quality Certification and are anticipated to be similar to those required for Charlesgate.
T-3	Implement measures to prevent dried sediments from becoming airborne.	Hydraulic dredging and dewatering do not create sediments dry enough to become airborne. If sediments are spilled on site, dust control procedures specified in the contract documents will be adopted.
T-4	[The FEIR] should detail mitigation measures for fish and other vertebrate and invertebrate species impacts.	See Sections 9.7, 9.8 and 9.9
T-5	[The FEIR] should comply with water quality standards during dredging and discharge of return water.	See Section 2. Monitoring of water quality is proposed.
T-6	A natural soil layer exists beneath the river sediments, not a clay layer as stated in the DEIR. [The FEIR] should discuss how	Dredging depths were determined by required flood channel dimensions.

Table 11-1
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CODE	SUMMARY	RESPONSE
	dredging depths were determined and how to protect the natural soil layer.	
T-7	[The FEIR] should discuss necessary sediment quality/depth to provide suitable spawning habitat for blueback herring.	The environmental enhancements to the Muddy River are anticipated to result in the migration of greater numbers of the blueback herring to Leverett Pond. The blueback herring is an anadromous fish that migrates to fresh water to spawn. Spawning takes place from mid-May through June. Eggs of the blueback herring sink and stick to anything they contact. Good sediment quality is very important for the survival of the eggs. Toxic or highly organic sediments are not as suitable as are relatively clean granular (sandy) bottoms. The young return to salt water within a few months of hatching.
T-8	[The FEIR] should clarify how the additional 30% TSS removal will be achieved and show proportion of removal assigned to each type of BMP.	The 30% reduction in solids loading will be achieved through a variety of source and non-source control measures, such as improvements in street sweeping, catch basin cleaning, structural BMPs as part of the project as well as new BMPs required by private redevelopment. The proportion of removal for each BMP is described in Section 5.
T-9	[The FEIR] should include a comprehensive alternatives analysis of stormwater management measures with full cost-benefit analysis.	A cost comparison of in-stream basins to sedimentation tanks or basins outside of the river is presented in Section 4 of this FEIR. Out-of-stream alternatives are more than double the cost of the in-stream basins per cubic yard of sediment trapped.
T-10	[The FEIR] should include much more data on in-stream sedimentation basins. Specific questions about in-stream sedimentation basins have to be answered in the FEIR.	A discussion of the technical and regulatory aspects of in-stream basins is presented in Sections 3 and 4 of this FEIR.
T-11	Scope and immediately implement existing particle separator study proposed in DEIR so results can be incorporated into the FEIR.	The pilot program on BMPs began in Fall 2002. Data collection of numerous storm events is necessary for the study to be effective. Results of the pilot program will be used in siting/designing additional particle separators in the watershed.
T-12	[The FEIR] should discuss the alternatives recommended by the Center For Watershed Protection in the Village Brook watershed in the context of the pilot plan.	Structural BMPs identified by the Center for Watershed Protection in the Village Brook watershed were re-evaluated for inclusion in the FEIR. Several BMPs identified by the CWP were eliminated from the BMP program, while several others are being investigated further for feasibility. See Section 5 for additional details.
T-13	Require commitment from MDC for effective stormwater management.	See Section 6. The proponents and the MDC have met several times to begin crafting an agreement to include the MDC in the management and maintenance planning of the project.
T-14	[The FEIR] should have specific responsibilities and written commitments of each proponent for stormwater control maintenance.	Section 6 addresses costs. The MOU currently being amended will commit funding.

Table 11-1
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CODE	SUMMARY	RESPONSE
T-15	[The FEIR] should discuss funding sources for long-term implementation of stormwater maintenance.	Section 6 addresses costs. The MOU currently being amended will commit funding.
T-16	Non-structural BMPs are underfunded.	The analysis shows that the benefits from further increases in already aggressive non-structural programs beyond project recommendations have limited solids reduction impacts, and therefore further expenditures would have diminishing water quality benefits.
T-17	$1,000/yr for waterfowl control split seems low	See Section 5. This cost has been increased although much of the cost is to be borne by existing staff.
T-18	A preferred management alternative should be selected and discussed in the FEIR.	See Section 6 for a discussion of management structure, which is proposed as a Public/Private Partnership with an independent Environmental Improvements Committee to provide a forum for discussion of all project elements.
T-19	Implement monitoring and careful control of invasive plants.	Monitoring of invasives is proposed beyond construction as discussed in Section 10.
T-20	Brookline and Boston should be required to commit in writing to their maintenance responsibilities.	See Section 6.
T-21	Proponents should work with surrounding developers to minimize stormwater impacts.	This will be implemented as part of a Consent Decree and new stormwater regulations. Brookline will be considering a new bylaw in the spring.
T-22	Expand water quality monitoring to include oil and grease.	Oil and grease are not regulated parameters, but we have included TPH in the monitoring plan.
LETTER U - THE EMERALD NECKLACE CONSERVANCY		
U-1	[The FEIR] should show graphically the previous flood levels and the new ones as a result of project implementation	These are shown in the stream profile hydraulic gradeline drawings in Section 6 of the DEIR. The hydraulic model is not sufficiently detailed to show an accurate areal extent of flooding.
U-2	Recommend consideration of a creative way to deal with toxics on site.	Hazardous wastes are federally regulated and could not be permitted for onsite disposal. Contaminated material retained on site would affect the historic landscape.
U-3	Have scour studies been done to ensure that existing bridges are not harmed?	The improved hydraulic conditions will reduce scouring at structures because the dredging will increase channel cross-sectional area, thereby decreasing velocity. The owners of each structure should independently prepare a scour study as part of future maintenance.
U-4	Constructability reviews at the present level of design should be done by construction professionals.	Comment acknowledged.
U-5	The Preliminary Design Report for Charlesgate should be consistent with the description, contractor requirements and commitments made in the DEIR.	Since the Charlesgate construction documents were approved by permitting agencies, this is no longer needed.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
U-6	Truck routing for Charlesgate work should consider access to westbound ramp of the Turnpike at Mass Ave. and Newbury Street.	This routing could be used for westbound trucking but there is no eastbound equivalent, so that Mass Ave-Rt 93 was recommended.
U-7	[The FEIR] should explore creative solutions (pipe-jacking, raised decks) to construction in the Brookline Ave. area to minimize impacts to residents, public, and abutters.	Foundation conditions do not favor pipe jacking, especially with the utility interferences. Raised decks were considered but may create traffic slowdowns in non-construction lanes. Other construction methods will be considered during final design and permitting.
U-8	[The FEIR] should be more definite regarding the expected success rate of basin wide BMPs.	Removal rates of BMPs vary widely depending on the type of BMP, proper sizing, and maintenance. Limited literature is available on the effectiveness of specific BMPs, though specific type of BMPs were thoroughly evaluated for suitability in the watershed. The pilot program on particle separators will provide data on effectiveness on these types of structural BMPs.
U-9	How will the contract for plantings be set up?	Plantings will be specified in the construction contract with a 2-year guarantee period.
U-10	[The FEIR] should list each mitigation item with its cost.	Mitigation items are listed in the Section 61 Findings found in Section 10. Costs are normally lumped in the general contract conditions.
U-11	[The FEIR] should require that contract performance standards be incorporated into every contract regarding contractor on-site and off-site parking, hrs of operation, and site cleanliness.	These issues are incorporated into the Charlesgate specifications and will be carried into future construction contracts. These are also part of the Section 61 Findings in Section 10.
U-12	[The FEIR] should require the design and implementation of a public communication program with specific requirements.	The proponents included a public information meeting prior to Charlesgate and included public information signs as part of the specifications. These signs are expected to be part of the future construction program.
U-13	Further study the history and management structure of New York's Central Park Conservancy and Prospect Park Alliance, and Fairmount Park Commission and private non-profit "friends" groups in Philadelphia.	See Section 6 for a discussion of alternative management structures evaluated and the proposed management structure (Public/Private Partnership).
U-14	A Joint Powers Act entity management structure should be studied in detail and findings should be presented in the FEIR.	See Section 6 for a discussion of alternative management structures evaluated and the proposed management structure (Public/Private Partnership).
U-15	Continued maintenance by the three existing park agencies over their jurisdictional areas under a cooperation agreement should be studied further.	See Section 6 for a discussion of alternative management structures evaluated and the proposed management structure (Public/Private Partnership).
U-16	[The FEIR] should require the proponents to investigate a strong cooperative management structure and clearly specify the geographical reach of this entity. The ENC do not support the creation of a special park commission.	See Section 6 for a discussion of alternative management structures evaluated and the proposed management structure (Public/Private Partnership).
U-17	[The FEIR] should address which parks would benefit from a cooperative and unified management structure.	See Section 6 for a discussion of alternative management structures evaluated and the proposed management structure (Public/Private Partnership).

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
U-18	The Maintenance Plan should clearly state that it is part of a larger maintenance plan for the entire Emerald Necklace park system. The plan should identify an overall maintenance standard.	See Section 6 - The maintenance plan addresses the parks adjacent to the Muddy River Project area.
U-19	Section 8.1.1. outlines objectives. Goals need to added identifying purpose of plan.	Section 10 outlines measurable goals for each aspect of the project rather than tied specifically to the objectives.
U-20	Subdivide and prioritize grass areas, if appropriate, for maintenance efficiency.	See Section 6 and Appendix F for a geographic breakdown of turf maintenance.
U-21	Are the plantings in Table 8-5 an estimate or based on a previous estimate (from the Master Plan)?	Plantings in Table 8-5 are taken from Appendix I in Volume 6 of the DEIR and expressed in square feet to estimate maintenance costs.
U-22	Section 8.5.3, who will hire and oversee the position and role of a park coordinator? Will equipment purchases be made through joint purchase agreements?	See Section 6 for proposed management structure. Equipment purchases would be part of the owning entities budget process.
U-23	The recommendation to develop a two-year, park wide tree removal program needs a guiding plan (part of restoration design or combined with a woodlands management plan).	Comment accepted.
U-24	Are the recommendations for additions of staff actual additions or will some percentage of this number be supplemented by outside assistance from government or private sources?	Overall staffing levels are addressed in Section 6. Some of the skills required will likely be fulfilled by contract services.
U-25	Reword in Section 8.6.2, #6, from "Also develop consistent replanting scheme to regularly replant from a list of historical and ecological importance" to …from a list of historically, aesthetically and/or ecologically appropriate species."	Comment acknowledged.
U-26	[The FEIR] should more fully scope project funding questions.	Additional funding commitments were made in support of the Final Record of Decision and will be in the re-negotiated MOU. When the ACOE decision document becomes public, funding will become more clear.
LETTER V - BROOKLINE TOWN MEETING MEMBERS FROM PRECINCT ONE		
V-1	Strongly believes that the Carlton Street Footbridge restoration should not be included in the Project due to excessive cost, doubtful historical significance, lack of handicapped accessibility, security, and safety concerns.	See Section 7. To be decided by the Town of Brookline at Town Meeting 2003.
LETTER W - ROGER FRYMIRE		
W-1	All maintenance responsibilities of the Project should be removed from the MDC based on their historic neglect of maintenance (as detailed in his letter).	See Section 6. The proponents and the MDC have met several times to begin crafting an agreement to include the MDC in the management and maintenance planning of the project.
LETTER X - DEPARTMENT OF ENVIRONMENTAL PROTECTION		
WETLANDS PROTECTION ACT		

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
X-1	A Variance from the MA WPA will be required for the "bank-to-bank" dredging in the Riverway and upstream areas. The DEIR failed to provide analysis of how the project will enhance wetland functions above and beyond what currently exists.	This aspect of the project can meet the criteria for approval as a Limited Project per 310 CMR 10.53(4), as well as a variance. Please refer to Section 4 of this FEIR for a discussion of bank to bank dredging and the ability of this aspect of the project to be approved per the Wetland Protection Act.
X-2	The four "over-dredged" areas require a Variance since they constitute in-stream stormwater detention basins and are not permitted under the WPA.	It is our opinion that the "over-dredged" areas are not in-stream detention basins as they will not detain stormwater -- they are merely depressions within the channel. The WPA does not prohibit over-dredging. Please see Section 4 of this FEIR for a discussion of the in-stream basins and the ability for these to be permitted pursuant to the Wetland Protection Regulations and the Water Quality Certification Regulations.
X-3	[The FEIR] should show the locations on a plan where wetland resource area increases will take place and describe increases in a narrative.	Figures showing wetland restoration and replication areas are presented in Section 12 of this FEIR and a description of the restoration and replication areas is presented in Section 3.
X-4	[The FEIR] should provide more detail that 1:1 replication/restoration will be provided.	Table 3-4 in Section 3 documents a net increase the Bank, Land Under Water and BVW within the Muddy River corridor resulting from the proposed project.
X-5	[The FEIR] should provide additional details on BVW alteration and replication, including locations of lost BVW and replication.	See Section 3 for a description of the wetland restoration and replication, and Section 12 for location of restoration and replication areas. The plans to date are preliminary and final grading plans will be prepared during permitting to show more definitive limits of wetland loss, restoration and replication.
X-6	[The FEIR] should describe the type of soil to be used on the shelves and how the shelves will be stabilized prior to establishment of the wetland plants.	See Section 3 for a description of wetland restoration and replication procedures, including soil type.
X-7	[The FEIR] should discuss what methods other than a barge-mounted machine can be used for Phragmites removal, explain why barge-mounted machine was selected as preferred. Describe if different methods proposed for different areas.	A description of dredging alternatives and the preferred removal method is presented in Section 4. Use of mechanical removal for *Phragmites* is proposed for *Phragmites* growing within the channel. For *Phragmites* growing outside of the dredging limits a combination of herbicides and mechanical removal is proposed.
X-8	The DEIR, Section 6.2.2.5, refers to Section 5 for details on invasive species removal. DEP could not find these details.	The correct reference should be 2.1.5 and 2.3.4.
	401 WATER QUALITY CERTIFICATION	
X-9	[The FEIR] should correct the impression left from the DEIR that the 401 WQC is inconsequential and discuss in detail the WQC jurisdiction.	See Section 4 for the discussion detailing the jurisdiction of the Section 401 Water Quality Certification (WQC) program and the ability of this project to meet the requirements of the WQC regulations.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
X-10	[The FEIR] should demonstrate that no other practicable alternative exists to the creation of the six in-stream basins for stormwater treatment in order for the work to be permittable under 401 WQC and Chapter 91 regulations.	The discussion of alternatives to the proposed in-stream basins is presented in Section 4 for both the WPA and WQC regulations. This same discussion is germane to the Chapter 91 regulations as well.
X-11	[The FEIR] should address the potential negative biological impacts of the in-stream basins.	The potential negative effects are identified in Section 3 and evaluated. No adverse biological effects are anticipated as a result of dredging in-stream basins.
X-12	The proposed generic mixing zone seems excessive. Develop site specific approach to defining mixing zones.	See Section 3 for a discussion of site specific mixing zones for the proposed filtrate discharge locations.
X-13	The proposed SS limit of 200% of background within 200 ft of dredging also seems excessive. DEP likely to impose lower limit. [The FEIR] should discuss how the background is defined. DEP prefers real-time measurements.	See Section 3. A 200-foot mixing zone is appropriate for all discharges, except for the discharge to Leverett Pond, which is suggested to be 300 feet to ensure adequate mixing.
X-14	[The FEIR] should outline the corrective actions for water quality exceedances and include criteria for defining an exceedance.	Water quality monitoring is proposed during and after construction, as discussed in Sections 2 (during dewatering) and 10. Exceedances of Class B standards or Water Quality Certification criteria will result in specific actions to correct problems. During construction, the contractor will be required to increase engineering controls if limits are not met.
X-15	Allowable TSS or turbidity to be returned to the river should be linked to the reference location TSS or turbidity rather than the proposed limits.	The discharge limits in the WQC for Charlesgate are not linked to a reference location, and we expect that this approach will be used for the rest of the project as well.
X-16	Individuals hired to capture and release of Three-Spine Sticklebacks will need appropriate certification, license, and/or permits.	Comment acknowledged.
X-17	Capture and release any fish or amphibians impounded within work area by silt curtains.	Fish and/or reptiles in the work zones will be captured using electro-shock collection or other techniques (e.g., netting, which was used at Charlesgate) and released outside of the work zone, prior to the start of dredging operations, as described in Section 3 of the FEIR.
X-18	[The FEIR] needs expand the discussions relative to WQC jurisdiction.	See response to Comment X-9 above.
	DREDGING AND SEDIMENT MANAGEMENT	
X-19	[The FEIR] should address aquatic "polymer toxicity" from backdraining of the belt-filter pressate. Contractor should submit MSD sheets and review the data for toxicity to the aquatic environment.	The contractor will be required to submit MSD sheets, and the engineer will assess the toxicity of the products proposed for use. The toxicity of the Callaway 4400 series polymer and the AC-645 Long Duration Foam for odor and dust control is discussed in Section 2.6.3.
X-20	DEP assumes contractor will need to perform pre-dredge "debris-field" clearance.	The specifications will indicate that debris is expected and must be removed. See Section 2.3.2.3.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
X-21	Will TC-Lead material be treated at the staging areas, if so, where will the facility be sited?	The preferred alternative for the Back Bay Fens is to dewater TC-Lead sediments at the Agassiz Road staging area and to store them in roll-off containers at the Lagoon staging area, pending receipt of test results. See Section 2.6.6.
X-22	[The FEIR] should have a final plan on TC-Lead treatment. DEP to work with consultant.	See response to no. X-21 above.
X-23	Unclear whether proponents plan to "lime-stabilize" sediments. DEP to work with consultant.	Lime stabilization will be used as needed, and the contractor will be required to have the facilities on site. See Section 2.6.4.
X-24	[The FEIR] should discuss the need for post-dewatering sampling if required by a receiving facility or for "unusual" batches.	CDM has identified three facilities that can accept dewatered sediment based on the in-situ testing and the opinion of an LSP. Quantities of "unusual" materials are likely to be small and the contractor will have to provide for them if encountered. See Section 2.6.5.
X-25	When discussing physical/biological aspects of sediment, criteria developed by "Long, et al." (ERL and ERM) are more relevant than DEP's lined and unlined landfill reuse levels.	The comparisons of sediment levels to lined and unlined landfill reuse levels were used to assess the appropriate means and methods to dispose of dredged sediments. It is agreed that risk assessment of biological impacts from contaminants found in river sediments, or remaining in the river, should utilize appropriate ecological bench-mark levels rather than DEP lined and unlined landfill reuse levels. The Army Corps of Engineers (ACOE) completed an ecological risk assessment of Muddy River sediment, as reported in Section 3 of this FEIR. The ACOE report does not refer to ELMs or ERMs referenced in "Long, et al." However, other acceptable threshold response criteria were utilized by the Corps: 1) bulk sediment chemistry data were compared to "probable effect concentrations (PEC's)" developed by McDonald et al. (2000) and 2) food chain modeling results were compared to threshold-response values (TRVs). Once sediment is dredged from the river and ponds, use of DEP's sediment levels for lined and unlined landfill reuse levels is appropriate.
X-26	[The FEIR] should at least reference the draft of the ACOE report on using biological impacts for dredging justification.	The ecological risk assessment prepared for the ACOE report documents that river sediments are toxic to aquatic life and this report is referenced in the FEIR to justify dredging.
X-27	Use of contaminant criteria in Table 1 of DEP's Policy COMM-97-001 are for reuse of material at lined or unlined landfills.	Section 2 has been revised to reflect this.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
X-28	[The FEIR] should discuss what type of sampling/decontamination will be necessary after each staging area is returned to its prior use.	Soil sampling in areas to be daylighted was discussed in the Preliminary Design Report, Appendix I of DEIR, page 2-7. The soils were found to be uncontaminated and suitable for off-site reuse. Appendix E of this Final EIR provides these test results as a supplement to information provided in Appendix C of the Draft EIR. Additional testing of these soils may be necessary during construction, prior to transport off site.
X-29	DEP assumes soil sampling, characterization, management will need to be incorporated for the daylighting areas proposed for excavation.	See response to X-28.
X-30	Post-dredging/dewatering sampling may be necessary to classify the sediments for approval to go to a specific management facility. This should be incorporated into staging area development/layout and material processing planning.	See the response to question X-24 above.
X-31	The DEIR uses disposal to refer to general management of sediments, including reuse.	The FEIR has been revised to reflect this distinction.
X-32	The actual reuse/disposal sites/facilities the project proponents and/or contractors are considering using should be discussed, not critical for the FEIR	See the response to question X-24 above. In addition, the engineer must approve the contractor's submittals of proposed landfills
STORMWATER MANAGEMENT AND POLLUTION CONTROL		
X-33	[The FEIR] should discuss in more detail how funding will be provided for park and BMP maintenance for areas controlled by the MDC.	Funding commitments were made as part of the FROD and the MOU and MOA are to be renegotiated as noted in Section 6. The MDC funding is subject to legislative approval that neither proponent can directly affect, although both proponents will support MDC budgets to fund the maintenance identified in this agreement.
X-34	The Maintenance Plan should include a mechanism whereby some % of funds for each project phase be set aside for maintenance.	Capital funds can not be applied to future maintenance. Maintenance funding will be the subject of amended MOU and MOA.
X-35	[The FEIR] should address in greater detail the shared management structure that will be used for the project	See Section 6 for a discussion of alternative management structures evaluated and the proposed management structure (Public/Private Partnership).
X-36	[The FEIR] should clarify the intent of the text in Section 8.2.2, page 8-9. and Fig. 8-2 as it relates to DEP's responsibility to ensure requirements of the MEPA Certification.	See Section 6 for a discussion of alternative management structures evaluated and the proposed management structure (Public/Private Partnership).

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CODE	SUMMARY	RESPONSE
X-37	[The FEIR] should address the inconsistency in the 2-yr monitoring of plantings required by the proponents vs. the 5-yr monitoring for wetland replication projects through WQC and WPA Variance.	The proponents are required by permit to monitor wetland replication for 5 years. The 2-year guarantee period is a Contractor guarantee period for release of construction funds. It is not practical to hold the Contractor funds beyond 2 years so the proponent will be responsible for maintaining wetlands replication after 2 years.
	ALTERNATIVES AND CONTINGENCY PLANNING	
X-38	[The FEIR] should discuss alternative phasing or a reduced project scope if funding is not forthcoming.	The proponents consider the project to be an integrated approach for the Muddy River. Unless and until funds are not available, they are not considering a phased approach.
X-39	[The FEIR] should clarify which areas are being dredged Bank-to-Bank and which partially dredged. Define term partially.	In the Back Bay Fens, partial dredging would consist of a 30-foot wide channel within the river that would be adequate for alleviating flooding. However, bank-to-bank dredging is proposed in order to remove the growth of invasive species. In the Riverway, partial dredging would consist of removing the growth of invasive species in three locations where the flood capacity of the channel has been reduced. However, bank-to-bank dredging is proposed in order to restore the historic capacity of the channel (see Section 2.4.2). In the ponds, partial dredging is proposed, consisting of the removal of sediment in selected areas.
X-40	The DEIR states that Bank-to-Bank dredging is needed in the Riverway to avoid compromising the flood capacity of the Back Bay Fens and that Phragmites removal is needed. DEP believes this is incorrect.	See Section 4
X-41	Is there a significantly less costly "Plan B" to reduce flooding problems if funding for the entire project becomes problematic.	Flooding problems can only be corrected with infrastructure improvements (culverts and daylighting) and dredging downstream of the former Sears parking lot. Based on studies by the ACOE, the minimum cost for this work would be $45 million. This would not include any BMPs or rehabilitation.
	MISCELLANEOUS COMMENTS	
X-42	[The FEIR] should note that a Chapter 91 license is required.	Comment acknowledged.
X-43	It's unclear how the Charlesgate portion will be handled under the EIR procedures as it relates to the EIR Challenge Period for Final EIRs. State agencies cannot issue permits until challenge period ends.	No response required.
X-44	Significant monitoring of the Charlesgate work should take place.	Weekly meetings (to which regulators are invited) are held on site during active construction periods.

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CODE	SUMMARY	RESPONSE
X-45	[The FEIR] should more fully discuss control of dust during construction.	Dust control is included as a submittal by the Contractor to be approved prior to construction and is included in the Section 61 Findings in Section 10.
X-46	[The FEIR} should update Table 7-1, Mitigation and Project Impacts.	Mitigation is addressed in Section 10 (see Table 10-1).
X-47	[The FEIR] should discuss the scope and reporting procedures for the EM.	An Environmental Monitor will be included in the engineering services for the duration of the construction contract.
X-48	The Contractor's DMMP should be submitted to DEP for review/comment.	Comment acknowledged.
X-49	There is information missing from the Section 61 Findings (DEP's CACI, lime stabilization, management of sediment reuse/disposal facilities, 24-hr hotline, offsite noise control, etc.)	See Section 10 for a discussion of mitigation measures. Also see Section 2 for discussion of lime stabilization and sediment management. The BPRD has a contact number for all construction and other park-related complaints that they will maintain throughout this project. Noise measurements, using appropriate field sound equipment will be carried out by the contractor on a weekly basis. The IEM will be provided these results and may request to witness the measurements. Should noise levels exceed the allowed limit measured at locations indicated in the regulations, the contractor will take steps as necessary to reduce noise to levels acceptable to the Resident Engineer and responsible municipal officials. With respect to CACI, for the Charlesgate contract, the contractor certified that all onsite diesel powered equipment has been fitted with after-engine emission controls. Low sulfur diesel fuel is also being used in the same equipment. A similar requirement will be made for subsequent work.
X-50	BWSC has agreed to coordinate their efforts to study the effectiveness of their particle separators in the watershed. The proponents will be responsible for conducting the work, and BWSC indicated they would share their results.	Comment acknowledged.
X-51	[The FEIR] should discuss in more detail that the responsibilities for funding, enforcement, and monitoring of BMPs rests on the proponents.	See Section 6 for discussion of BMP maintenance and monitoring.
X-52	[The FEIR] should clarify inconsistent statements regarding compliance with water quality stds.	The Muddy River is classified as Class B, but the data show that while quality has improved in some areas, it still does not meet Class B standards.

Table 11-1
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CODE	SUMMARY	RESPONSE
X-53	Address potential water quality problems where significant grouting/cement work will occur.	Construction work, including concrete work, will be subject to permitting conditions. Control of releases on site will be included in the construction documents.
X-54	[The FEIR] should include a plan for handling asbestos.	Construction specifications dealing with utility relocation will include asbestos handling. Asbestos is not a concern for dredging and rehabilitation work.
	VOLUME 2	
X-55	The MWRA is not the key player relative to resolving the water quality in the Muddy River basin, the problems are stormwater and illicit connections outside of MWRA's jurisdiction.	Comment acknowledged.
X-56	The Muddy River WQS is Class B(CSO), not Class B.	Comment acknowledged.
	APPENDIX K, RESPONSE TO DEP COMMENTS	
X-57	N-5, Response does not fully deal with second part of comment "and the project impacts can be limited to those necessary for enhancing natural capacity of the system to improve flood control and for prevention of pollution"	A discussion of the project to meet limited project criteria pursuant to 310 CMR 10.53(4) is included in Section 4.
X-58	N-33, DEP does not believe that the response fully addressed the comment and is not consistent with other DEIR sections that state that upstream sediment will not significantly adversely affect downstream Phase I dredging.	The magnitude of dredging is further discussed and justified in Section 4.
X-59	N-58, Based on discussions with the proponents there is no existing scope of work. Ultimate coordination would be part of the final mgt structure to be selected for the FEIR and BMP coordination will be an Annual Update topic.	Comment acknowledged.
X-60	N-68, need text to describe commitment to retrofitting onsite diesel-powered construction equipment with after-engine controls and use of low sulfur diesel fuel.	See Section 61 Findings in Section 10.
	LETTER Y - DEPARTMENT OF ENVIRONMENTAL MANAGEMENT	
Y-1	The DEIR does not clearly explain which water and land areas of the Emerald Necklace Park System compromise the Phase 1 project area.	The Phase I area covers the Muddy River watershed from the river's confluence with the Charles River extending 3.5 miles upstream to Wards Pond.
Y-2	Clarification is needed on the difference in scope of Phase I Project, the Environmental Master Plan, and the Emerald Necklace Master Plan.	The project is Phase I of the 4-phase 1999 Emerald Necklace Environmental Improvements Master Plan (ENF) and is consistent with the broader 1989 Emerald Necklace Parks Master Plan, which covers the park network from Back Bay to Jamaica Pond.
Y-3	[The FEIR] must show historic preservation as laying the foundation for, and reinforcing, the engineering solutions of Phase I Project.	Justification for the dredging solutions are reinforced in Section 2, 3 and 4. The infrastructure justification is predicated on flood mitigation rather than historic preservation although the treatment of the new infrastructure is consistent with historic context.

Table 11-1
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CODE	SUMMARY	RESPONSE
Y-4	[The FEIR] should describe the preservation of the landscape in greater detail, include sequence of rehabilitation projects and conceptual plans in adherence to the Master Plan.	Conceptual landscape rehabilitation plans are included in Appendix I of the DEIR. These plans are in adherence to the Master Plan.
Y-5	[The FEIR] should dispense with preservation jargon such as primary and secondary periods of significance and reference to the "Continuum".	Comment acknowledged.
Y-6	[The FEIR] must include 'Preserve Landscape and Historic Resources" in its list of project objectives.	Project objectives are addressed in Section 1 (including historic resources).
Y-7	The DEIR does not address clogging of hydraulic dredge and pipeline if Phragmites and their root systems are not removed.	In general, the contractor will perform this work in a way that minimizes equipment problems, such as clogging of the hydraulic dredge. Phragmites and root systems will be removed before the river is dredged.
Y-8	DEM concurs with use of hydraulic dredging with mechanical dewatering. DEM recommends use of City water if additional filtering is needed before discharge back to the river.	There is no need to use City water in the dewatering process.
Y-9	The DEIR lacks discussion on decontamination of equipment during the removal of contaminated sediments.	Equipment used for contaminated sediments will be decontaminated using accepted practices which will included in the specifications.
Y-10	[The FEIR] needs to contain a BMP Plan that includes all measures in DEIR, a planning/permitting/construction schedule, a commitment from proponents to implement the plan and a dedicated funding source.	A comprehensive BMP program is being designed for Phase I, to included increased frequency in source control measures such as street sweeping and catch basin cleaning, and evaluation and design of numerous structural BMPs throughout the watershed
Y-11	Recommend that BMP plan be expanded to address all stated project objectives.	The BMP plan includes a variety of measures designed to meet the stated project objectives. The first of these is the 30% reduction in solids loading to the river.
Y-12	Condition the MEPA approval for Charlesgate on the proponents preparing a plan/work schedule for implementation this calendar year of the basin-wide non-structural BMPs, as described in Section 5.7.1 of the DEIR.	No response required.
Y-13	The proponents must complete by the end of 2002 the proposed studies to determine which system-wide BMPs will be used.	The BMP plan discussed in Section 5 includes proposed studies to design and implement specific structural BMPs to pilot in the watershed.
Y-14	Contract plan should also be reviewed by funding agencies, permitting agencies and CAC. A mechanism for corrective action needs to be in place.	Design drawings were presented to the CAC and submitted to all permitting agencies for Charlesgate. The resident engineer, along with the Environmental Monitor, are responsible for monitoring the contractor's compliance.
Y-15	[The FEIR] should define the Independent EM's responsibilities, authority, and chain of command. The IEM needs to have the authority to stop work.	The Environmental Monitor reports back to the proponents and project manager, not through the construction manager. The proponent has the authority to suspend work.
Y-16	[The FEIR] must include mitigation measures that protect the extant historic and cultural resources in the project area. Consult with MHC, and if applicable, Boston Landmarks Commission and Brookline Preservation Commission.	See Section 7. Consultation with MHC and other parties will occur during final design to ensure adequate mitigation is incorporated in construction plans.

Table 11-1
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CODE	SUMMARY	RESPONSE
Y-17	[The FEIR] Executive Summary should be a public information document.	Comment acknowledged.
Y-18	[The FEIR] should include a comprehensive public information and outreach strategy, to include fact sheets, website, on-site interpretation.	The proponents have scheduled public information meetings and included public information requirements in the construction documents. A web site for the project is now operational. This is discussed in Section 7.3.7 of the DEIR.
Y-19	The Management and Maintenance Plan needs to be a requirement of the FEIR and include measurable environmental performance standards. Plan should present acceptable strategy for closing gap between hrs needed for maintenance and hrs currently available.	See Section 6 for a discussion of maintenance and management roles and responsibilities.
Y-20	List additional elements that need to be included in the annual updates described in the DEIR (mileposts, summary of reports, fund summary, budget and funding source for coming year, monitoring information summary, copies of ACOE and Charlesgate annual inspection reports). Annual report should be reviewed and commented on by the CAC, any oversight body, funding and permitting agencies, noticed in the EM, and circulated to commentaries to the ENF and EIRs.	See Section 6 for a revised outline and discussion of the Annual Update.
Y-21	MEPA should require establishment of an Emerald Necklace Parks environmental oversight committee with independent Committee Administrator.	An independent oversight committee has been proposed (the Environmental Improvements Committee). See Section 6 for further discussion.
Y-22	Retain the CAC as an advisory committee to MEPA and whatever management structure is established.	See Section 6. The CAC will continue to provide input through review of the Annual Updates.
Y-23	DEM recommends that Boston and Brookline establish a dedicated trust account to fund operation and maintenance.	See Section 6. Funding of maintenance will be included in a revised MOU.
Y-24	The maintenance plan for Charlesgate should include semi-annual maintenance tasks, work schedule, budget, and source of funds.	Two years of maintenance and a schedule of maintenance for Charlesgate are included in the construction contract. The revised MOU will outline the MDC responsibilities and requirements for funding and maintaining this section of the project.
Y-25	Establish performance standards or environmental indicators to judge if hydraulic capacity in Charlesgate channel is being maintained after dredging.	These are part of the overall project maintenance plan that includes measuring sediments on a periodic basis.
Y-26	Establish annual project inspection schedule for Charlesgate with federal and state project sponsors, management board and CAC.	Section 6 includes overall project monitoring requirements. The funding agency for Charlesgate has not added additional requirements at this time.
Y-27	Complete by Dec. 2002 the studies (listed in Section 5.5.1 of DEIR) to determine which structural BMPs will be installed at Charlesgate.	See Section 6. The changes to the Stony Brook Conduit that are part of the source control BMPs most significantly impact Charlesgate.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
Y-28	Complete a landscape plan for restoration of land disturbed in the process of sediment removal (Charlesgate).	This will be the subject of a public design process with the MDC.
LETTER Z - TOWN OF BROOKLINE		
Z-1	Letter provides an update of funding strategy presented in the DEIR.	No response required.
LETTER AA - MASSACHUSETTS EMERGENCY MANAGEMENT AGENCY		
AA-1	In support of the project	No response required.
LETTER BB - US DEPT. OF THE INTERIOR, NATIONAL PARK SERVICE		
BB-1	The historical intent and character of the park system must set the context for decision-making throughout all phases of the planning, design, and construction.	The proponents concur.
LETTER CC - MASSACHUSETTS HISTORICAL COMMISSION		
CC-1	The construction of cascade aeration structures and large culverts may have an adverse effect on the character of the Muddy River and Olmsted Park System depending upon their size, location, and function. MHC requests more detailed plans, drawings, and technical information concerning the aeration process.	The aeration process is not part of the proposed project. The intent of the culvert headwall design is to provide stone facing on an arch culvert design in keeping with other historic structures on the river. This is indicated in Appendix I, Section 3.4.2 of the DEIR. Actual details will be provided to MHC as the design progresses.
CC-2	Demolition of any stone arch culverts would also constitute an adverse effect.	No stone arch culverts are proposed to be demolished.
CC-3	MHC requests more detailed drawings, plans, and technical information for culvert enlargements for the Brookline Ave., Riverway, and Avenue Louis Pasteur areas, incl. Info on new headwalls, and detailed plans for daylighting of the former Sears Parking Lot and upstream of Avenue Louis Pasteur.	Detailed drawings will be developed during design and reviewed with MHC once alternative construction methods are selected.
CC-4	MHC request that further documentation and proposed plans for the Carlton Street Footbridge be submitted to MHC as early in the planning stages as possible so all alternatives for its treatment can be considered.	See Section 7. Brookline is considering this issue in the Spring 2003 Town Meeting.
CC-5	The FEIR should include a more detailed analysis for a proposed maintenance plan to protect public investments.	See Section 6 for a detailed discussion of maintenance and management. Performance standards, and mitigation measures, are listed in Table 10-1.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
CC-6	MHC suggests the ACOE, Boston Landmarks Commission, and Brookline Preservation Commission meet to discuss the project once the public review period for the DEIR is closed to facilitate identifying consulting parties and to involve public in Section 106 process.	Preliminary meeting has been held, more meetings are expected.
LETTER DD - MASSACHUSETTS HISTORICAL COMMISSION DATED APRIL 12, 2002		
DD-1	Reiterating CC-4 (see previous). MHC requests that if demolition is proposed that alternatives have been carefully explored. Potential funding sources for preservation and rehabilitation should be investigated, explore historic preservation grants through TEA-21 Transportation Enhancement Program through FHA and MHD.	See Section 7. Brookline is considering this issue in the Spring 2003 Town Meeting.
LETTER EE - BROOKLINE CONSERVATION COMMISSION		
EE-1	[The FEIR] should include more analysis to ensure that the interests identified under the WPA are protected.	Section 4 evaluates the ability of the project to meet the limited project criteria for 310 CMR 10.53(4) relative to the interests of the WPA.
EE-2	[The FEIR] needs to further analyze ways to control resedimentation of the river.	The BMP Program is designed to reduce the sediment load from the watershed into the Muddy River. Restoring shoreline vegetation will reduce sediment loading from non-point sources.
EE-3	[The FEIR] should compare costs and benefits of the in-stream basins to other off-line treatments (including underground treatment/containment facilities, and/or seed control device evaluated in the pilot plan), determine if any alternative BMP would allow a greater than 30% reduction in sedimentation loads.	See Section 4 for additional justification and permitting issues on in-stream basins.
EE-4	Implement proposed Pilot Plan immediately so findings can be incorporated into the FEIR.	A pilot plan for sampling existing particle separators is underway.
EE-5	Level of analysis of BMPs that would prevent sediments from entering the river (source controls) falls short of the Con Com's requirements. Include more detailed analysis in [the FEIR].	A comprehensive BMP program is being designed for Phase I, to included increased frequency in source control measures such as street sweeping and catch basin cleaning, and evaluation and design of numerous structural BMPs throughout the watershed
EE-6	[The FEIR] should include detailed stormwater plans for the MDC and discuss efforts that will be made by Boston and Brookline in the Muddy River drainage areas above and beyond efforts in other areas.	The proponents and MDC have been involved in numerous discussions which address their source control efforts in Muddy River drainage areas. However, analysis done for the FEIR shows that improvements in source control measures provide limited solids reduction.
EE-7	[The FEIR] should examine possibility of putting swales in parklands around Leverett Pond.	Two swales for to control runoff volume and water quality are being evaluated for feasibility in the parklands adjacent to Leverett Pond.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
EE-8	[The FEIR] should include an analysis of additional runoff control measures for stabilizing Daisy Field and reducing runoff.	Project will include a particle separator for the watershed contributing to Daisy Field outlet. The ball field will be moved to reduce the runoff currently reaching Leverett Pond.
EE-9	Include analysis of reducing volume of stormwater generated (installation of rain barrels and infiltration devices); include costs and benefits.	Cisterns are not a viable option due to the large number of cisterns necessary to have even a small impact on reducing runoff.
EE-10	[The FEIR] should present work on waterfowl control efforts, including program costs and effectiveness.	Waterfowl control efforts will be addressed with Fish and Wildlife Departments. The proposed program will be based on current recommendations and is likely to be an iterative process until the right level and method of control is reached.
EE-11	The proponents must commit to maintenance in writing. Understands future expenses cannot be committed due to budgetary constraints.	See Section 6 for a discussion of maintenance commitments and responsibilities. The MOU and MOA will be renegotiated and will detail these issues.
EE-12	More analysis of and planning for sediment management from upstream sources must be completed before dredging at Charlesgate moves forward.	The Secretary of Environmental Affairs has allowed Charlesgate to proceed while a specific BMP plan addressing upstream sediment management is being prepared.
EE-13	Relief of constrictions and daylighting at former Sears Tower parking lot should be considered as a second priority action item (after Charlesgate).	The infrastructure improvements at the former Sears parking lot and dredging for flood relief are considered as the next most important element of the project.
EE-14	MDC and MHD must join the proponents in committing to their maintenance responsibilities. The state must commit the funds to enable the MDC to do so, or responsibility must be taken on by another agency.	See Section 6. The proponents and the MDC have met several times to begin drafting an agreement to include the MDC in the management and maintenance planning of the project. The proponents will be meeting with MHD concerning the street sweeping and catch basin cleaning elements along Route 9.
EE-15	[The FEIR] should identify and evaluate possible sources of contamination in the watershed (including Brookline's so-called Industrial Island). More sampling in sediment required for petroleum by-products.	Pollution sources should be identified as part of the development of stormwater discharge regulations. Sediment sampling included TPHs to aid in sediment disposal and not individual constituents to conduct source tracking. Source tracking is not always feasible with these tests.
EE-16	[The FEIR] needs to further develop dredging details, staging areas, contingency plans for wet weather, project phasing issues, and small-scale demonstration projects within the watershed to reduce pollution and improve water quality.	The FEIR includes more detail on dredging in Section 2, and the opportunity to use alternative BMP technologies in Section 5.
EE-17	[The FEIR] should include updates of on-going work with the BWSC and Brookline DPW. Specific projects requested.	Updates to relevant storm drain work as it relates to the Muddy River project are to be included in the Annual Update Report as discussed in Section 6.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
EE-18	Need more details on long-term management to prevent invasive species from reestablishing themselves; will mechanical, chemical, or other means be used?	A combination of herbicide control and mechanical removal of plants is proposed to control invasive species along the Muddy River. See Section 3 of this FEIR.
EE-19	To build support for long-term funding of this project, distribute reports and data to interested non-profit groups, members of CAC, interested universities, etc.	Reports have been provided to public libraries and a web site has been developed to provide the public access to the project information as developed.
LETTER FF - FRIENDS OF THE CARLTON STREET FOOTBRIDGE		
FF-1	MEPA should prohibit the proponents from taking actions that are counter to the intention of the Master Plan (i.e., demolition of Carlton Street Footbridge).	See Section 7. The Town of Brookline will address this issue at Town Meeting in spring 2003.
LETTER GG - TOWN OF BROOKLINE PRESERVATION COMMISSION		
GG-1	Commission would like to review the final planting and restoration plans in detail as the project evolves.	Comment acknowledged.
LETTER HH - BROOKLINE VILLAGE ACTION GROUPS		
HH-1	The Fens have become a man made no flow, flat Lagoon. The surface will remain at 7.5 through the system even with the proposed dredging and will not provide new storage for any rainstorm events	The elevation of the Fens at 7.5 ft (BCB) is controlled by the Charles River, and the project will not result in significant new storage. However, new storage would provide little flood control benefit on the river. For example, consider the runoff from a one-inch rainstorm over the entire Muddy River Basin, assuming 50% of the rain becomes runoff. That volume of water on the 6.5 square mile watershed is over 175 acre-feet. Thus, if it were feasible to retrofit the approximately 11-acre Leverett Pond as a "flood control" reservoir, and all runoff could be directed to the pond, the sides of the pond would need to be over 16 feet tall above the present water surface. Moreover, the water would have to be pumped into the pond, at extraordinary expense. Considering that the project is designed for much great rainfall amounts, storage by itself is not an effective mitigation measure. The flood control benefit derived from the project is from the increase in cross-sectional flow area in the channel and at roadway crossings. A doubling of cross-sectional area in many cases triples the discharge capacity of the channel.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
HH-2	CDM's statements that the river overflowed and flooded adjacent neighborhoods is not supported by the BWSC Report to the Mayor, the ACOE report, or the BVAG Report of the storm Oct 20-21, 1996, nor the June 13, 1998 storm event.	The flooding conditions have been adequately modeled using a model accepted by both the US Army Corps of Engineers and BWSC.
HH-3	The DEIR is lacking data relating to impacts of storm runoff from the drainage area to the river system, lacks runoff rates which cause fast rise of river surface in the lower reaches.	Impacts of storm runoff from the drainage area to the river system are discussed in the Section 5.3. A total of 2500 cubic yards per year of sediment is due to storm runoff into the river.
HH-4	The DEIR gives no insight how the thousand tons of street sand ends up in the river or how to deal with non-point entry at street catch basins.	Section 5 further describes the proposed BMP plan for the Muddy River watershed.
LETTER II - HIGH STREET HILL ASSOCIATION		
II-1	Maintenance should be required and guaranteed as a condition of the Secretary's Certificate. DEIR does not provide assurance of professional maintenance provided in other Olmsted parks. Need continuing appropriation from MA and federal government.	See Section 6 for a discussion of maintenance responsibilities and commitments, which will be finalized in the renegotiated MOU and MOA.
II-2	High level of commitment is not expressed in the DEIR to the goal of Historic Preservation (1 of the 5 goals)	Historic preservation is one of the five goals, as noted in the comment, and is therefore given a high level of attention.
II-3	Confusion regarding which islands in Leverett Pond will undergo shoreline stabilization.	Section 5.4.4 of the DEIR proposes removing invasive species on the two outer islands in Leverett Pond and replanting as needed. No shoreline work is anticipated. The center island will be reshaped and replanted and the shoreline stabilized since the original rehabilitation was unsuccessful.
II-4	Rehabilitating the headwall just north of Willow Pond should be part of the Babbling Brook restoration.	Rehabilitating this headwall did not appear necessary at this time.
II-5	Hoped to see regional solution recommended for control of the goose population.	A waterfowl control program will be developed by both the City of Boston and the Town of Brookline in late 2002 or early 2003, as discussed in the Draft EIR, to include plantings to keep waterfowl from the water's edge and signage to prevent feeding of waterfowl
II-6	Suggest further review of the negative impacts on wetlands and water quality if Daisy Field, even if it is moved slightly further away from the water's edge.	Moving Daisy Field slightly as proposed and reducing runoff would have long-term positive impacts on both wetlands and water quality over current conditions.
II-7	Brookline roads abutting the park should have same (or higher) standard of maintenance, BMPs, and travel restrictions as MDC Parkways (this was not mentioned in the DEIR)	The proposed management structure in Section 6 is planned to facilitate all parties meeting more common maintenance standards.
II-8	Concerned with the construction process (noise, smell, contamination from staging area at Leverett Pond).	Mitigation of construction impacts is included in the Section 61 Findings (Section 10).
II-9	CAC should remain for the life of the project.	The CAC will remain involved beyond construction. See Section 6 for further discussion of roles and responsibilities.
II-10	Require proponents to show stewardship now by instituting BMPs, graffiti removal, staff training, etc.	Increased maintenance standards discussed in Section 6 and renegotiated MOU and MOA will formalize maintenance commitments.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
LETTER JJ - MUSEUM OF FINE ARTS		
JJ-1	In support of the project.	No response required.
LETTER KK - THE FENWAY ALLIANCE		
KK-1	In support of the project.	No response required.
LETTER LL - BOSTON WATER AND SEWER COMMISSION		
LL-1	[The FEIR] needs to state what agency will own, inspect, and maintain the new culverts. The DEIR implies the BWSC will be responsible for the maintenance which has not been established.	The City of Boston will own culverts under city streets. Maintenance responsibility will be resolved internally in the City.
LL-2	[The FEIR] should note that many programs and activities required under the BWSM NPDES Stormwater Permit were being implemented before the permit was issued (sewer use regulations, site plan requirements, illegal connection remediation program, sewer separation programs, and sewer, drain and catch basin cleaning and maintenance).	See Section 5.3.1
LL-3	Section 2, p. 2-102, states: Thirteen new illegal connections were found in 2000…The commission is aware of only four, one identified in 2000.	The correction is noted.
LL-4	The BWSC is not aware of any interconnections between sewers and drains in the Cleveland Circle and Bartlet Crescent area (as stated on p. 4-76.	Comment acknowledged.
LL-5	There are no CSOs in the Emmanuel College area. Separation of combined sewers tributary to the Stony Brook Conduit is ongoing.	Comment acknowledged.
LL-6	[The FEIR] should note that BWSC has an effective means of preventing new illegal connections.	See Section 5.3.1
LL-7	[The FEIR] should provide clearer, more detailed explanation of the Stony Brook Conduit, the Old Stony Brook Conduit, and operation of the Back Bay Fens Gatehouses systems and their relationship to the Muddy River.	See Sections 5.3.2 and 5.4.2
LL-8	[The FEIR] should specify when flows from the Stony Brook Conduit and Gatehouse No. 1 (GH1) discharge to the Fens pond.	See Sections 5.3.2 and 5.4.2
LL-9	[The FEIR] should clarify that Gatehouse No. 2 is no longer operational. The relatively small flows from Old Stony Brook Conduit pass by the gatehouse and on to the Boston Marginal Conduit and MWRA's Prison Point CSO facility.	See Sections 5.3.2 and 5.4.2
LL-10	P. 4-6 states that repair of the three sluice gates in GH1 will allow more flow into the Muddy River. This is not technically accurate; only 1 of 4 gates on GH1 is operable.	See Section 5.3.2

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
LL-11	The proposed Back Bay Fen Improvements must be designed and implemented so as to avoid negative impacts to the planned improvements to the Gatehouse by BWSC.	Comment acknowledged.
L-12	[The FEIR] should emphasize that BWSC is committed to several projects (listed in letter) that will, while reducing flooding potential in the Stony Brook System, improve the quality of discharges from the Stony Brook Conduit.	Comment acknowledged.
LL-13	The issues of design, construction and ownership of the particle separators should be confirmed before the FEIR is finalized.	The results from the pilot program on particle separators, currently underway, will provide valuable information to be used in the design and construction of additional particle separators in the watershed.
LL-14	The particle separator pilot program should also include an evaluation on which proposed particle separators are appropriate and will be effective in the locations specified. The FEIR should identify which agency(ies) will be responsible for implementing the pilot program and getting the funding.	The results from the pilot program on particle separators, currently underway, will provide valuable information to be used in appropriate siting and sizing of additional particle separators in the watershed. The pilot program is being implemented by the Boston Parks Department and funded by the project.
LL-15	[The FEIR] should seek an alternative for the Daisy Field Staging Area since the proposed location is directly over a BWSC storm drain. If no alternative is available contractor must take precautions to ensure negative impacts to storm drain do not occur.	The contractor will be required to protect the BWSC storm drain running under Daisy Field.
LL-16	The locations of the BWSC's storm drain from the Riverway to Leverett Pond should be shown on all contract plans. Contract documents should state driving or parking of heavy equipment over storm drains must be avoided.	Comment acknowledged.
LL-17	Plans for the proposed dredging pipeline at the Daisy Field Staging Area must be reviewed by the BWSC.	Comment acknowledged.
LL-18	[The FEIR] should include a brief discussion of BWSC regulations and requirements.	The DEIR discussed regulations and it would be a reasonable location for more discussion on the BWSC regulations. The Secretary did not require additional detail on this issue so it was not repeated in the FEIR.
LL-19	BWSC believes that best available technology is already being applied relative to stormwater BMPs in the Muddy River. Many BMPs have only been in effect for a short time and improvements in water quality may take several years yet.	For structural BMPs, best available technologies are already in place regarding particle separators.
LETTER MM - YMCA OF BOSTON		
MM-1	In support of the project.	No response required.
LETTER NN - CHARLES BEVERIDGE		
NN-1	The Carlton Street Footbridge was carefully designed by Olmsted to provide convenient access and landscape amenity for many users of his park and is today a crucial missing link in the Emerald Necklace.	See Section 7 for a discussion of the status of the footbridge. More information will be available following Brookline's spring 2003 Town Meeting.

Table 11-1
Responses to Comments on Draft EIR

CODE	SUMMARY	RESPONSE
LETTER OO - NEW ENGLAND CONSERVATORY		
OO-1	In support of the project.	No response required.
LETTER PP - HARVARD SCHOOL OF PUBLIC HEALTH		
PP-1	In support of the project.	No response required.
LETTER QQ - MASS COLLEGE OF ART		
QQ-1	In support of the project.	No response required.
LETTER RR - BOSTON REDEVELOPMENT AUTHORITY		
RR-1	The waterfowl control program should give priority to public education and plantings forming a barrier between the land and water, an annual review of their effectiveness should be submitted to MEPA under Special Review Procedure prior to any implementation of a reproductive control program.	Plantings are planned to reduce the problem. A report on the problem will be included in the Annual Update Report. A reproductive control program would be done only in concert with Dept. of Fisheries and Wildlife and other requirements.
RR-2	The replacement plantings should mitigate for the loss of habitat for avian species, especially for overnight roosting.	The planting list in Table 3-3 of Appendix I of the DEIR has been reviewed by the habitat specialist to address appropriate habitat improvements.
RR-3	A construction Management Plan needs to be executed with the Boston Transportation Dept.	Comment acknowledged.
RR-4	Establish a management structure capable of reaching a consensus on a standard of maintenance for the park and able to implement a maintenance program with consistency.	See Section 6 for a discussion of the management structure, which includes a proposed Public/Private Partnership with the ENC as the private partner.
LETTER SS - BERKLEE COLLEGE OF MUSIC		
SS-1	In support of the project	No response required.
LETTER TT - FRIENDS OF THE MUDDY RIVER		
TT-1	Object to the proposed new asphalt bicycle path on the Boston (east) side of the Riverway in the new 2001 Edition of the Master Plan.	This comment should be addressed to the Commonwealth agencies responsible for the development of the Master Plan.

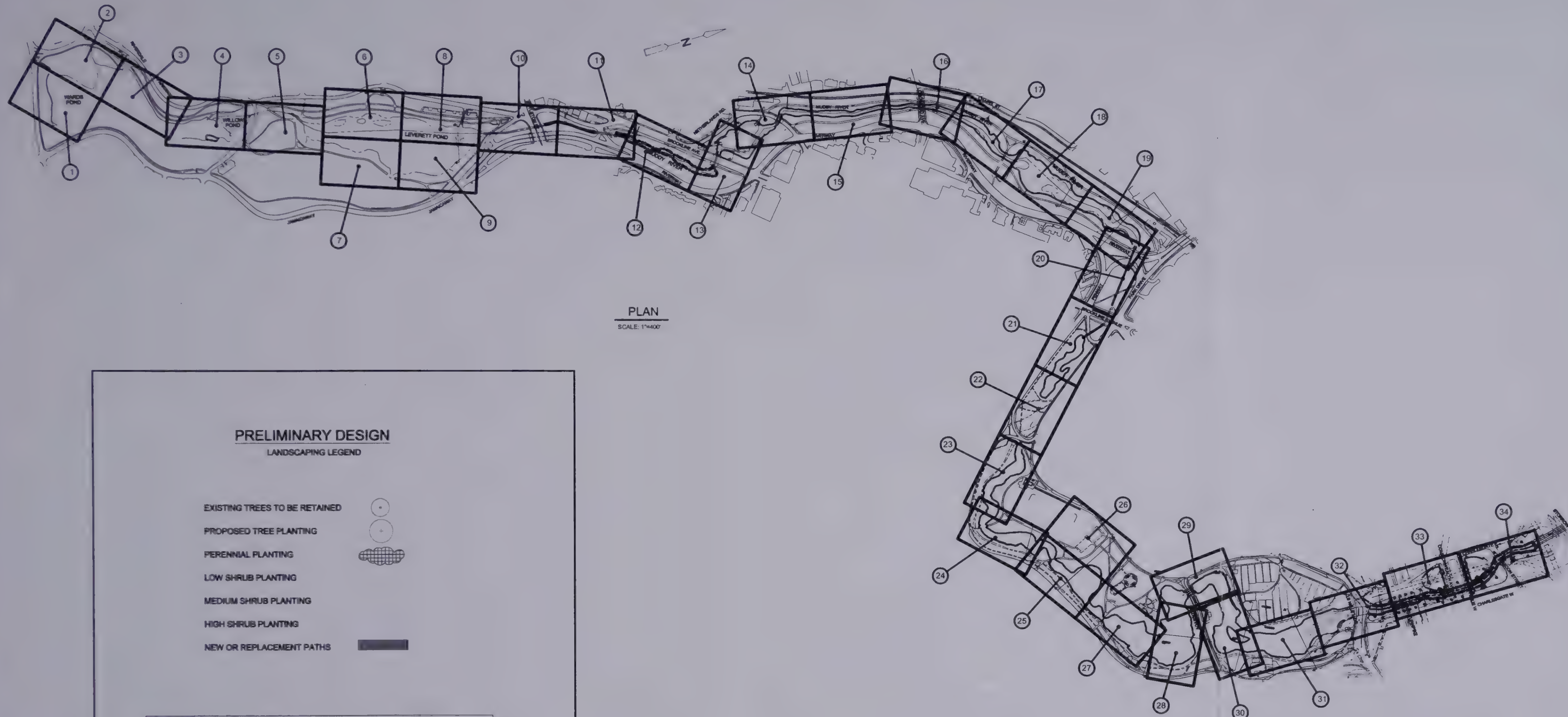
12

Section Twelve

Section 12
Wetland Figures

This section contains figures referenced in Section 3 of this Final EIR. The figures include the following:

- Landscape plans showing areas of wetland restoration and replication; and
- Cross-sections showing the transition from wetland to upland areas.



PLAN

SCALE: 1"=400'

PRELIMINARY DESIGN

LANDSCAPING LEGEND

- EXISTING TREES TO BE RETAINED
- PROPOSED TREE PLANTING
- PERENNIAL PLANTING
- LOW SHRUB PLANTING
- MEDIUM SHRUB PLANTING
- HIGH SHRUB PLANTING
- NEW OR REPLACEMENT PATHS

NOTES

1) All disturbed areas remaining after implementation of planting to be loamed and re-seeded (except where noted on drawings).
2) Appropriate wetland species to be planted along length of disturbed banks, to a width of 2'-0" (except where noted on drawings).

SHEET NUMBER

8

SHEET LIMITS

LEGEND

1" = 400'

200 0 400

APV. NO.	DATE	DRWN	CHKD	REMARKS	
					DESIGNED BY: D.DUNK
					DRAWN BY: M. TOUAYL
					SHEET CHK'D BY:
					CROSS CHK'D BY:
					APPROVED BY:
					DATE: JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

KEY PLAN

PROJECT NO.
FILE NAME
SHEET NO.
KEY

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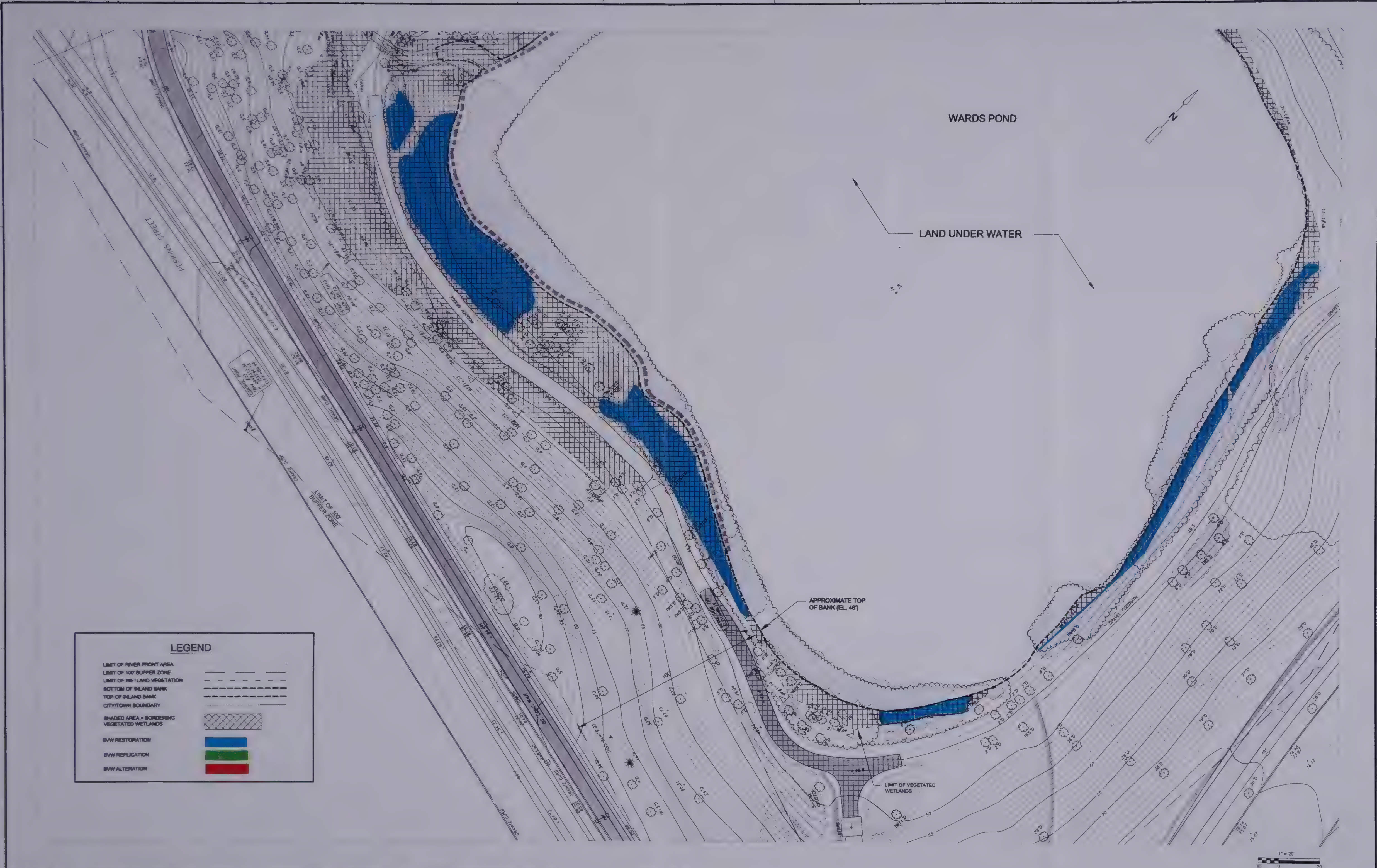

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 1

PROJECT NO.
FILE NAME

SHEET NO. 1

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DESIGNED BY	D. DUNK
DRAWN BY	M. TOUAYL
SHEET CHK'D BY	
CROSS CHK'D BY	
APPROVED BY	
DATE	JANUARY 2003

REV. NO. | DATE | DRWN | CHKD | REMARKS

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 2

PROJECT NO.
FILE NAME
SHEET NO. 2

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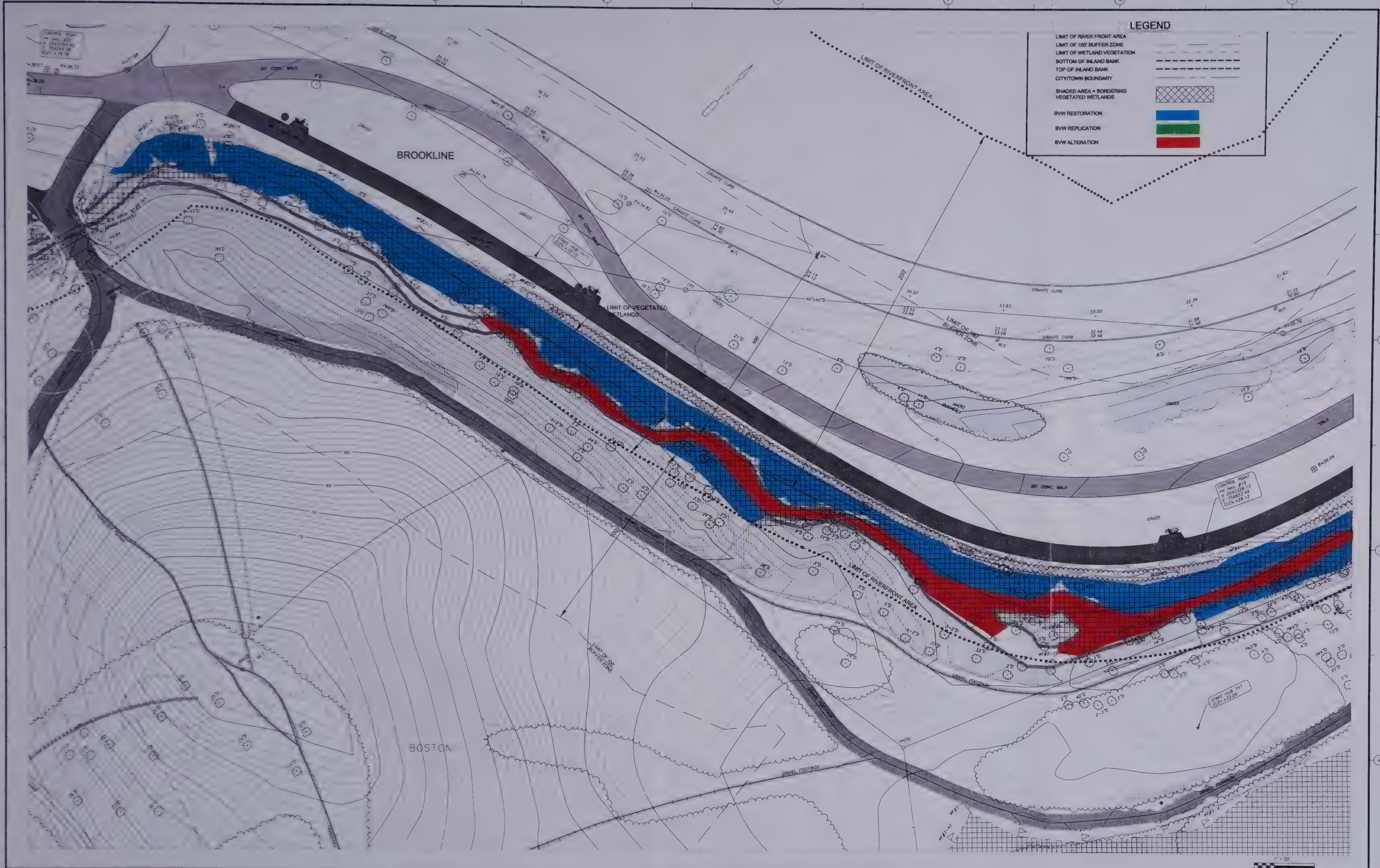

DESIGNED BY	D. DUNK
DRAWN BY	M. TOUAYL
DATE	JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT

IMPACTS AND MITIGATION

PLAN NO. 3

PROJECT NO
FILE NAME

SHEET NO 3

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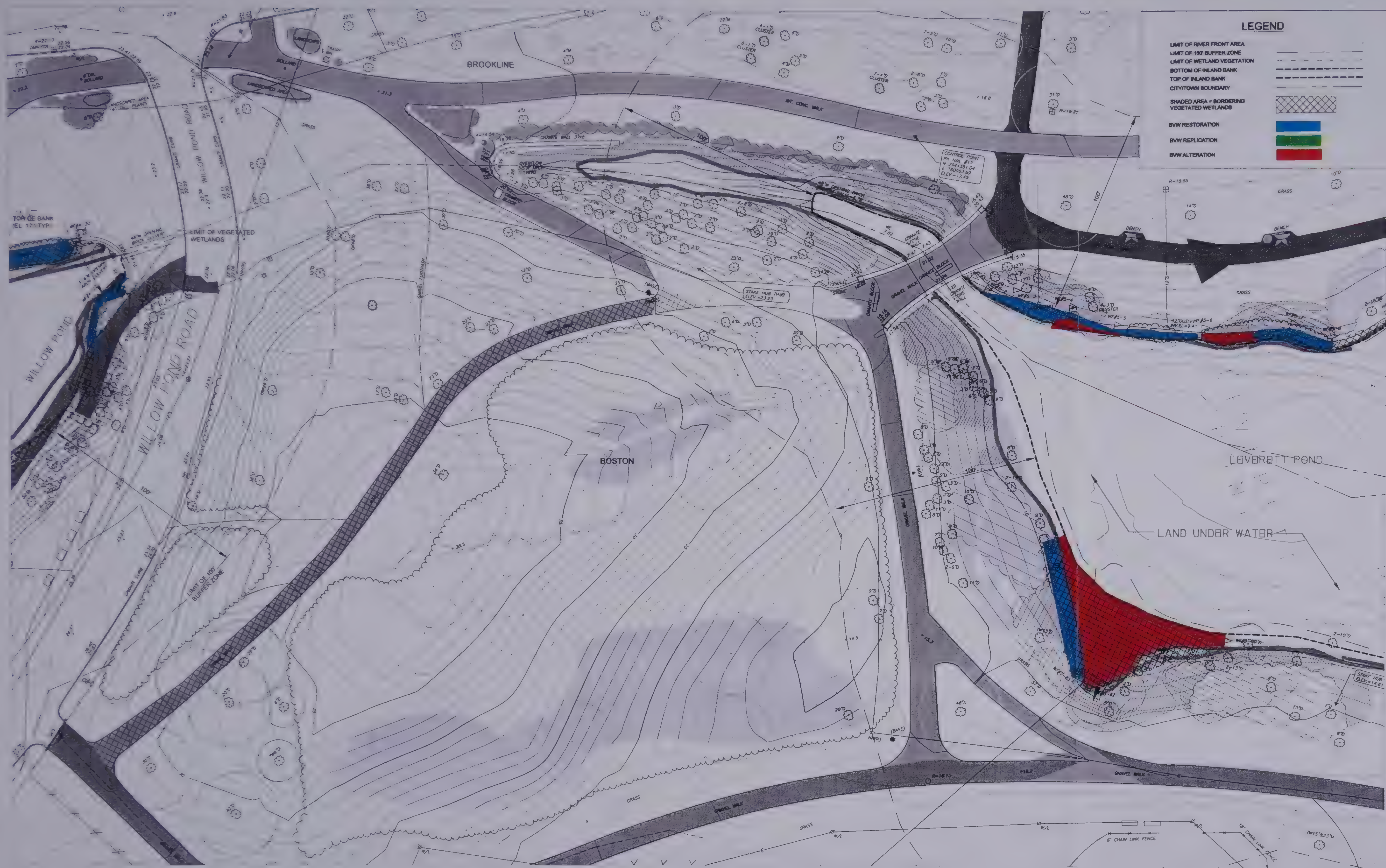
DESIGNED BY	D. DUNK	
DRAWN BY	M. TOUAYL	
DATE	JANUARY 2003	

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 4

SHEET NO. 4



[BOSTON PARKS AND RECREATION DEPT - MUDDY RIVER IMPROVEMENTS]

DESIGNED BY	D. DUNK
DRAWN BY	M. TOUAYL
DATE	JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT

IMPACTS AND MITIGATION

PLAN NO. 5

SHEET NO 5

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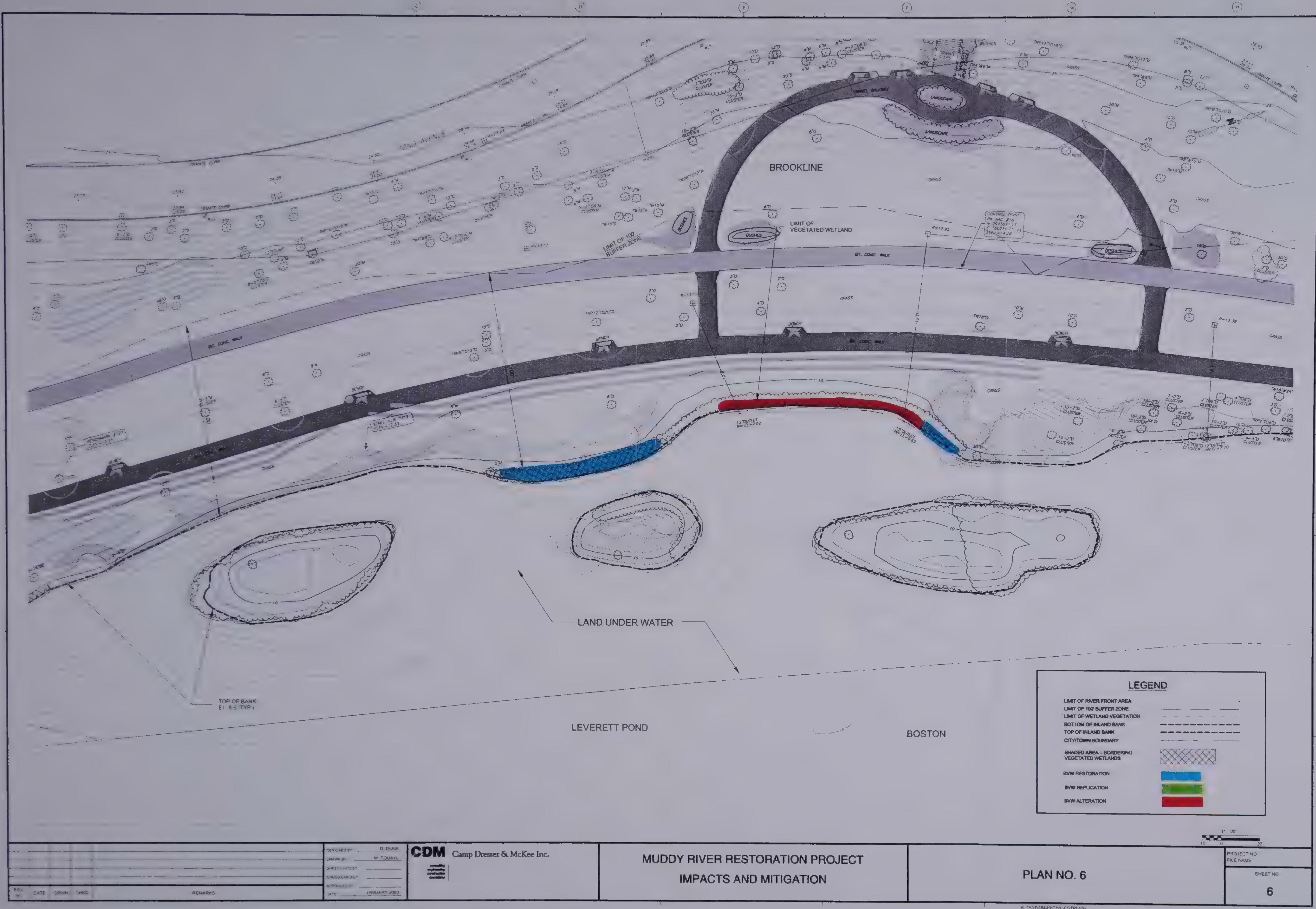
BROOKLINE
LIMIT OF VEGETATED WETLAND
LIMIT OF 100' BUFFER ZONE
LAND UNDER WATER
TOP OF BANK EL. 8.6 (TYP.)
LEVERETT POND
BOSTON
LEGEND
LIMIT OF RIVER FRONT AREA
LIMIT OF 100' BUFFER ZONE
LIMIT OF WETLAND VEGETATION
BOTTOM OF INLAND BANK
TOP OF INLAND BANK
CITY/TOWN BOUNDARY
SHADED AREA = BORDERING VEGETATED WETLANDS
BVW RESTORATION
BVW REPLICATION
BVW ALTERATION
CDM Camp Dresser & McKee Inc.
DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
DATE: JANUARY 2003
MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION
PLAN NO. 6
SHEET NO. 6

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 7

PROJECT NO.
FILE NAME

SHEET NO.
7

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REV NO.	DATE	DRWN	CHK'D	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 8

PROJECT NO.
FILE NAME
SHEET 8

R:1517\28449\CIVL CSTPL408

DESIGNED BY	D. DUNK	
DRAWN BY	M. TOUAYL	
SHEET CHK'D BY		
CROSS CHK'D BY		
APPROVED BY		
DATE	JANUARY 2003	

REV. NO. | DATE | DRAWN | CHK'D | REMARKS

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 9

PROJECT NO.
FILE NAME:
SHEET NO.
9

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REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2001

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 10

PROJECT NO.
FILE NAME
SHEET NO.
10

R:\1517\28449\CIVIL\CSTPL410

DESIGNED BY	D. TAUBE
DRAWN BY	M. TOUAYL
DATE	JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 11

SHEET NO. 11

R:\1517\28449\CIVIL\CSTPL411

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY D. DUNK
DRAWN BY M. TOUAYL
DATE JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 12

PROJECT NO
FILE NAME
SHEET NO
12

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY D. DUNK
DRAWN BY M. TOUAYL
SHEET CHKD BY
CROSS CHKD BY
APPROVED BY
DATE JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO.13

PROJECT NO.
FILE NAME

SHEET NO.
13

R: 1517:28449:CIVIL:CSTPL413

DESIGNED BY	D. DUNK
DRAWN BY	M. TOUAYL
DATE	JANUARY 2003

REV. NO. | DATE | DRWN | CHKD | REMARKS

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT

IMPACTS AND MITIGATION

PLAN NO.14

1" = 20'

PROJECT NO.
FILE NAME

SHEET NO.
14

R:\1517\28449\CIVIL\CSTPL414

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO.15

SHEET NO. 15

DATE: JANUARY 2003

REMARKS

DESIGNED BY D. DUNK
DRAWN BY M. TOUAYL
DATE JANUARY 2003

REV. NO. | DATE | DRWN | CHKD | REMARKS

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO.16

PROJECT NO.
FILE NAME
SHEET NO.
16

R:1517.28449\CIVIL\CSTPL416

DESIGNED BY	D. DUNK
DRAWN BY	M. TOUAYL
SHEET CHK'D BY	
CROSS CHK'D BY	
APPROVED BY	
DATE	JANUARY 2003

REV. NO. | DATE | DRWN | CHKD | REMARKS

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO.17

PROJECT NO.
FILE NAME

SHEET NO.
17

R:\1517\28449\CIVIL\CSTPL417

DESIGNED BY: D. DUNK DRAWN BY: M. TOUAYL DATE: JANUARY 2003	CDM Camp Dresser & McKee Inc.	MUDDY RIVER RESTORATION PROJECT IMPACTS AND MITIGATION	PLAN NO. 18

SHEET NO. 18

R 1517.28449.CIVL.CSTPL418

DESIGNED BY:	D. DUNK
DRAWN BY:	M. TOUAYL
SHEET CHKD BY:	
CROSS CHKD BY:	
APPROVED BY:	
DATE:	JANUARY 2003

NO. | DATE | DRWN | CHKD | REMARKS

CDM Camp Dresser & McKee Inc.

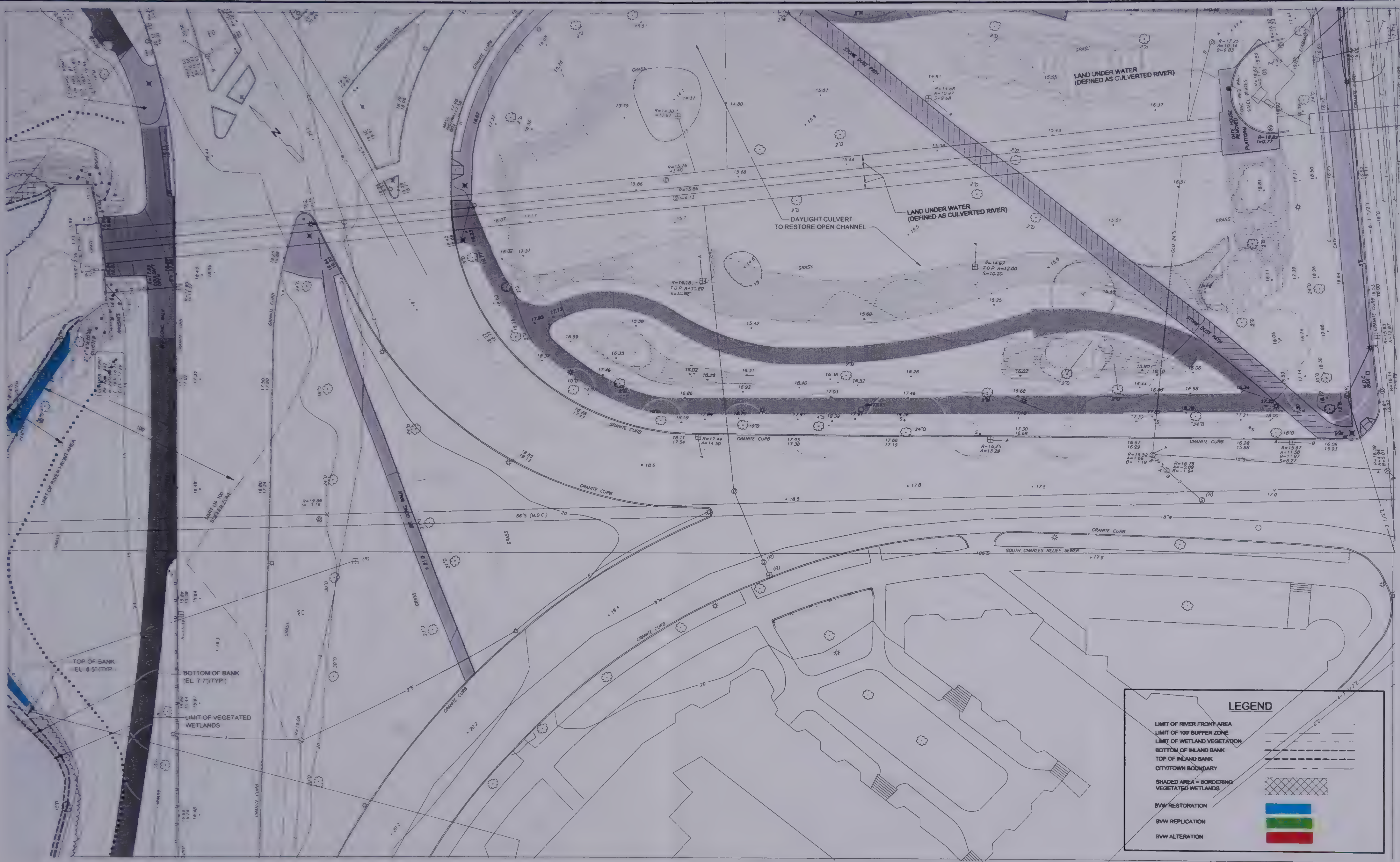
MUDDY RIVER RESTORATION PROJECT

IMPACTS AND MITIGATION

PLAN NO. 19

PROJECT NO.
FILE NAME

SHEET NO.
19



DESIGNED BY	D. DUNK
DRAWN BY	M. TOUAYL
DATE	JANUARY 2003

REV. | DATE | DRWN | CHKD | REMARKS

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 20

SHEET NO 20

R:1517.28449.CIVIL.CSTPL420

NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 21

PROJECT NO.
FILE NAME

SHEET NO.
21

R:1517\28449\CIVIL\CSTPL421

DESIGNED BY	D. DUNK
DRAWN BY	M. TOUAYL
DATE	JANUARY 2003

NO. | DATE | DRAWN | CHK'D | REMARKS

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 22

PROJECT NO
FILE NAME
SHEET NO
22

R:\1517\28449\CIVIL\CSTPL422

DESIGNED BY	D. DUNK	
DRAWN BY	M. TOUAYL	
DATE	JANUARY 2003	

REV. NO. | DATE | DRWN | CHKD | REMARKS

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 23

PROJECT NO.
FILE NAME

SHEET NO.
23

R:\1517\28449\CIVL\CSTPL423

LEGEND

LIMIT OF RIVER FRONT AREA
LIMIT OF 100' BUFFER ZONE
LIMIT OF WETLAND VEGETATION
BOTTOM OF INLAND BANK
TOP OF INLAND BANK
SHADED AREA = BORDERING VEGETATED WETLANDS

DESIGNED BY	D. DUNK
DRAWN BY	M. TOUAYL
SHEET CHK'D BY	
CROSS CHK'D BY	
APPROVED BY	
DATE	JANUARY 2003

REV. NO. | DATE | DRAWN | CHK'D | REMARKS

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
WETLAND DELINEATION

PLAN NO. 24

PROJECT NO.
FILE NAME
SHEET NO.
24

R:1517:28449\CIVIL\CSTPL424

DESIGNED BY	D. DUNK	
DRAWN BY	M. TOUAYL	
SHEET CHK'D BY		
CROSS CHK'D BY		
APPROVED BY		
DATE	JANUARY	

REV. NO. | DATE | DRWN | CHKD | REMARKS

CDM Camp Dresser & McKee Inc.

consulting engineering construction operations

MUDDY RIVER RESTORATION PROJECT

IMPACTS AND MITIGATION

PLAN NO. 25

PROJECT NO.

FILE NAME

SHEET NO.

25

R: 1517-28449\CIVIL CSTPL425

REV NO	DATE	DRAWN	CHKD	REMARKS

DESIGNED BY D. DUNK
DRAWN BY M. TOUAYL
SHEET CHK'D BY
CROSS CHK'D BY
APPROVED BY
DATE JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 26

PROJECT NO.
FILE NAME
SHEET NO.
26

DESIGNED BY	D. DUNK
DRAWN BY	M. TOUAYL
DATE	JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT

IMPACTS AND MITIGATION

PLAN NO. 27

PROJECT NO.
FILE NAME
SHEET NO.
27

REMARKS

R:\1517\28449\CIVIL\CSTPL427

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: R. DEARDON
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: SEPTEMBER 2000

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 28

PROJECT NO.
FILE NAME
SHEET NO.
28

DESIGNED BY	D. DUNK	**CDM** Camp Dresser & McKee Inc.
DRAWN BY	M. TOUAYL	
DATE	JANUARY 2003	

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 29

PROJECT NO.
FILE NAME
SHEET NO.
29

R: 1517 28449 CIVIL CSTPL429

REV NO	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

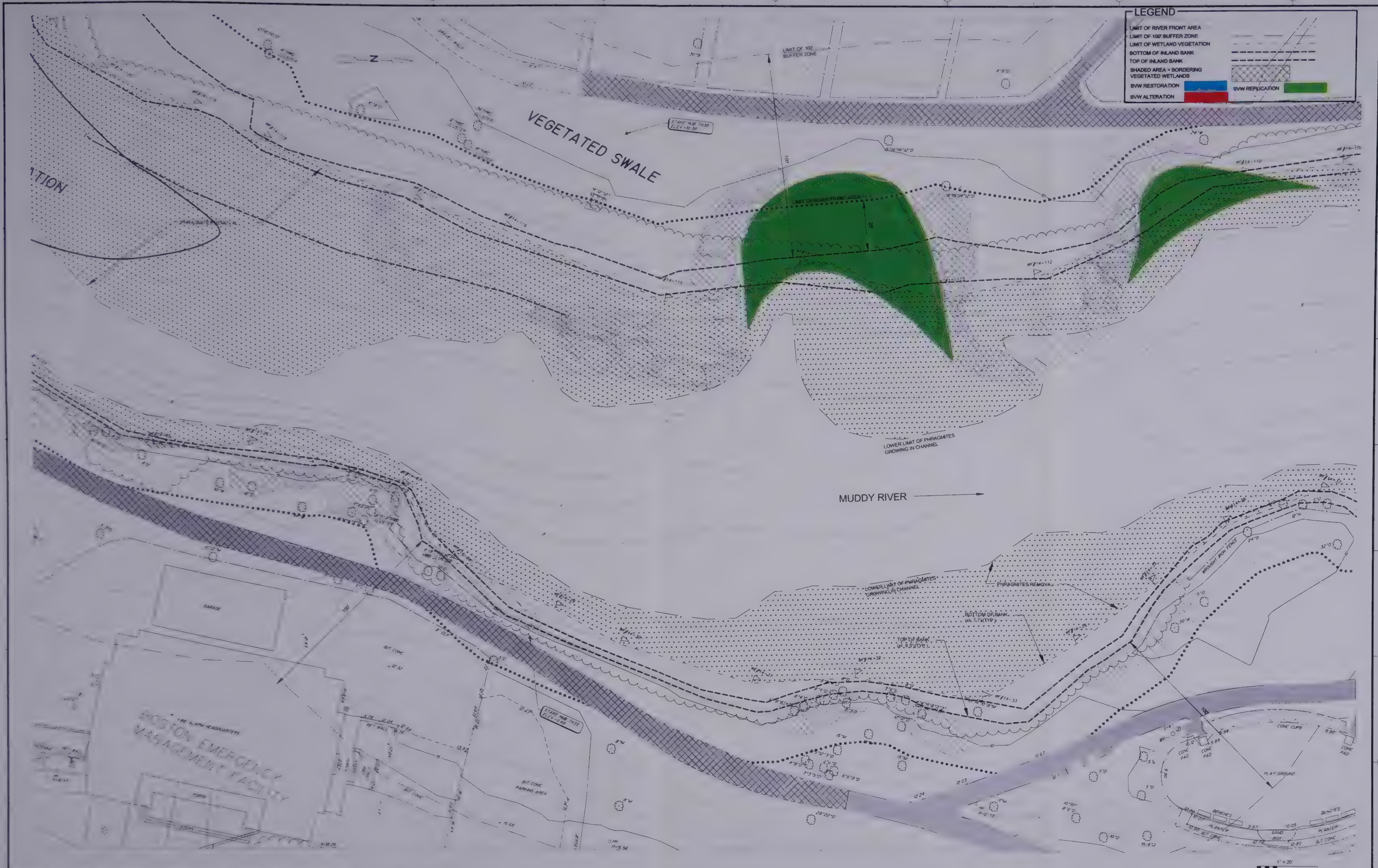
CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 30

PROJECT NO.
FILE NAME
SHEET NO.
30

R:1517:28449:CIVIL:CSTPL430



DESIGNED BY	J. STEELE
DRAWN BY	R. DEARDON
DATE	SEPTEMBER 2000

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 31

PROJECT NO
FILE NAME

SHEET NO
31

R:\1517\28449\CIVL\CSTPL431

CDM Camp Dresser & McKee Inc.

DESIGNED BY D. DUNK

DATE JANUARY 2003

REV NO | DATE | DRWN | CHKD | REMARKS

MUDDY RIVER RESTORATION PROJECT

IMPACTS AND MITIGATION

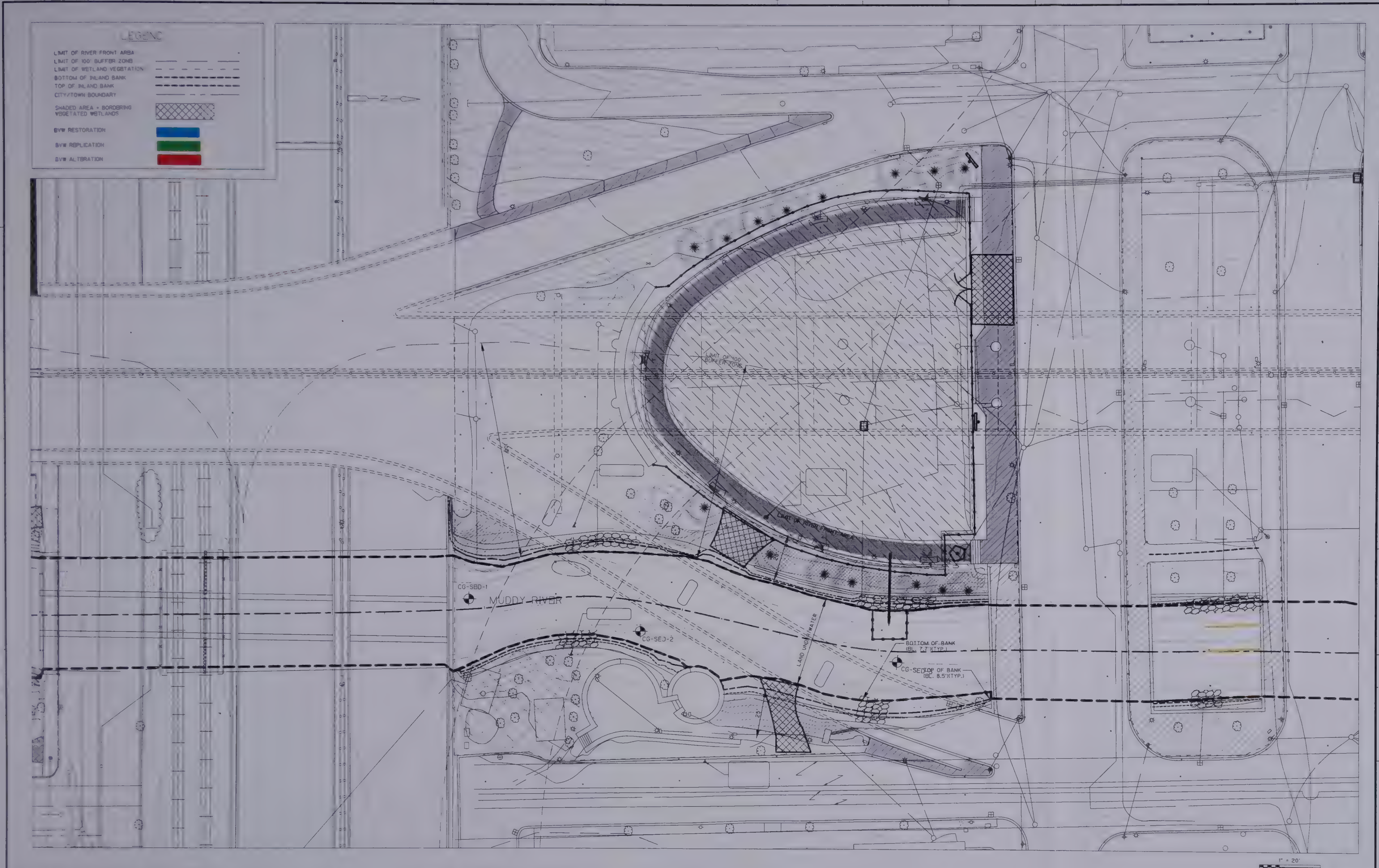
PLAN NO. 32

PROJECT NO

FILE NAME

SHEET NO

32



DRAWN BY: R. DEARDON
DATE: SEPTEMBER 2000

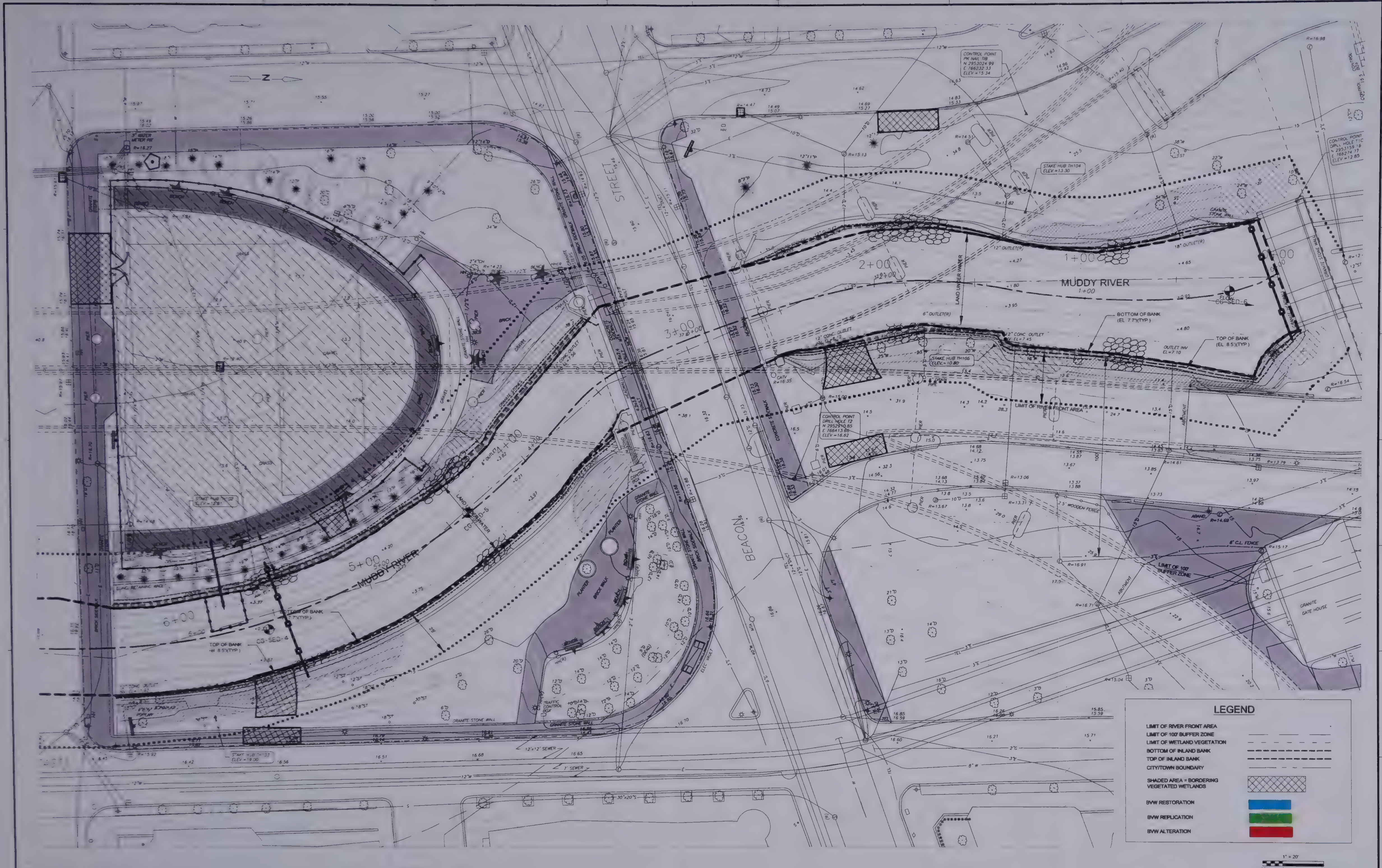
CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 33

PROJECT NO.
FILE NAME:
SHEET NO
33

R:\1517\28449\CIVIL\CSTPL433



REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY D. DUNK
DRAWN BY M. TOUAYL
SHEET CHK'D BY
CROSS CHK'D BY
APPROVED BY
DATE JANUARY 2003

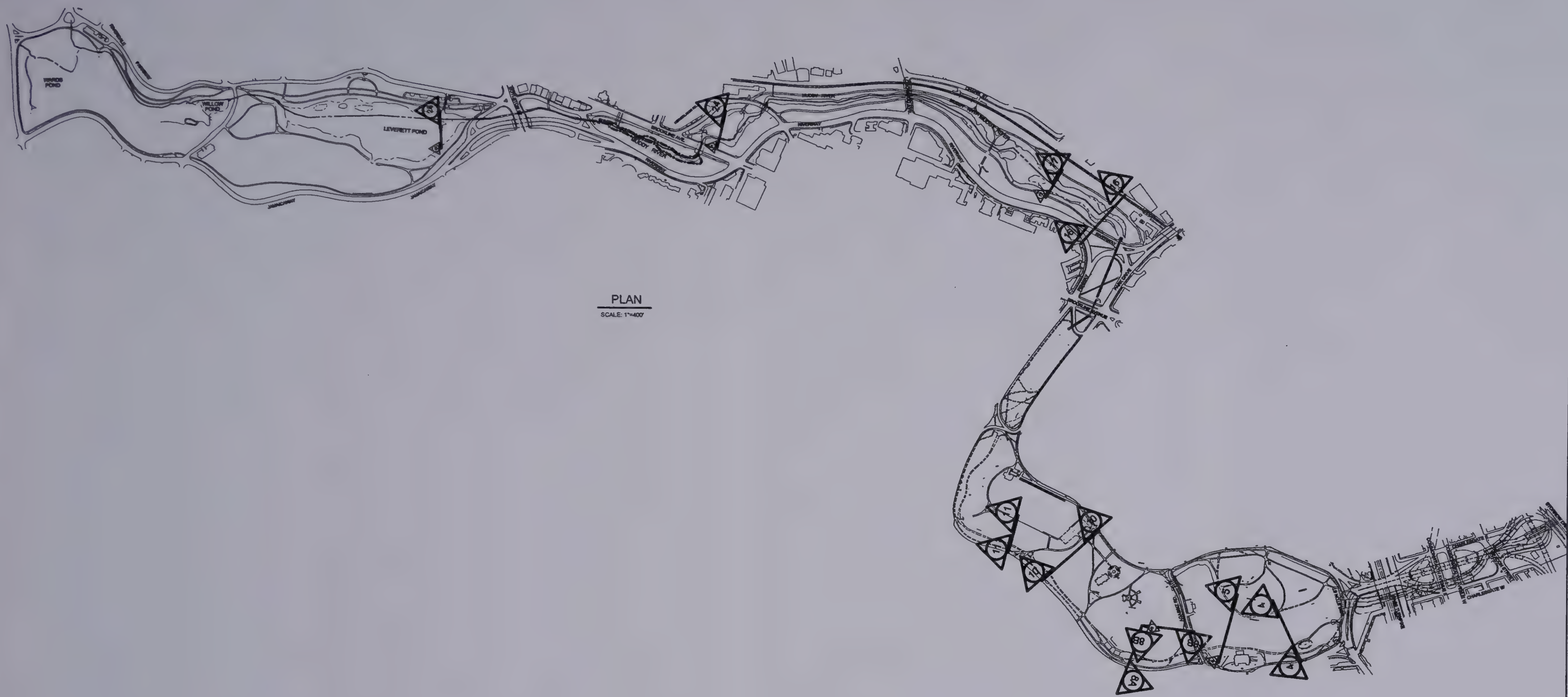
CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN NO. 34

PROJECT NO
FILE NAME

SHEET NO
34



1" = 400'
200 0 400

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D.DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

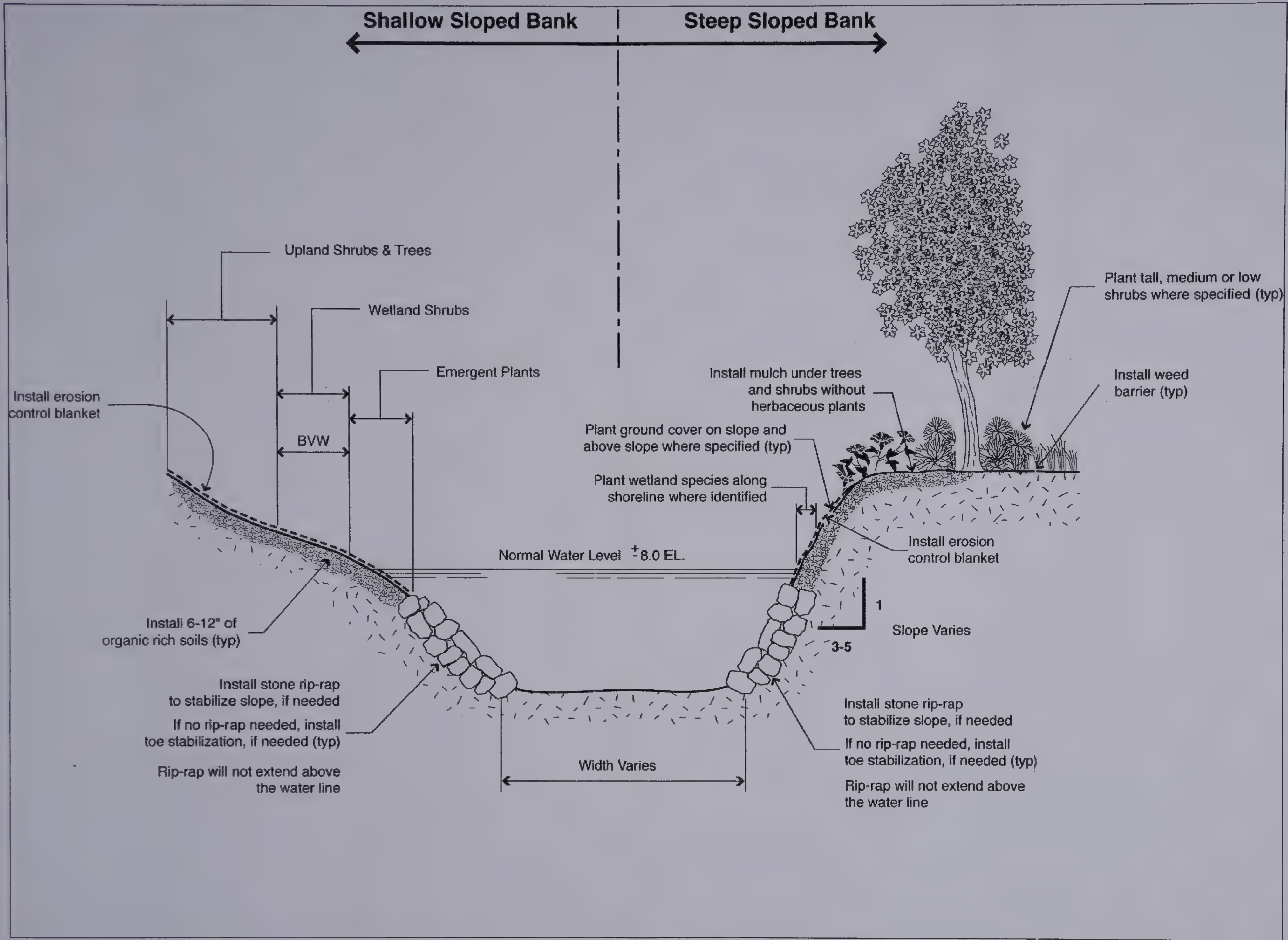
CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

KEY PLAN

PROJECT NO.
FILE NAME:
SHEET NO.
KEY

R:\1517\28449\CIVL\KEYSECT1



REV NO	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

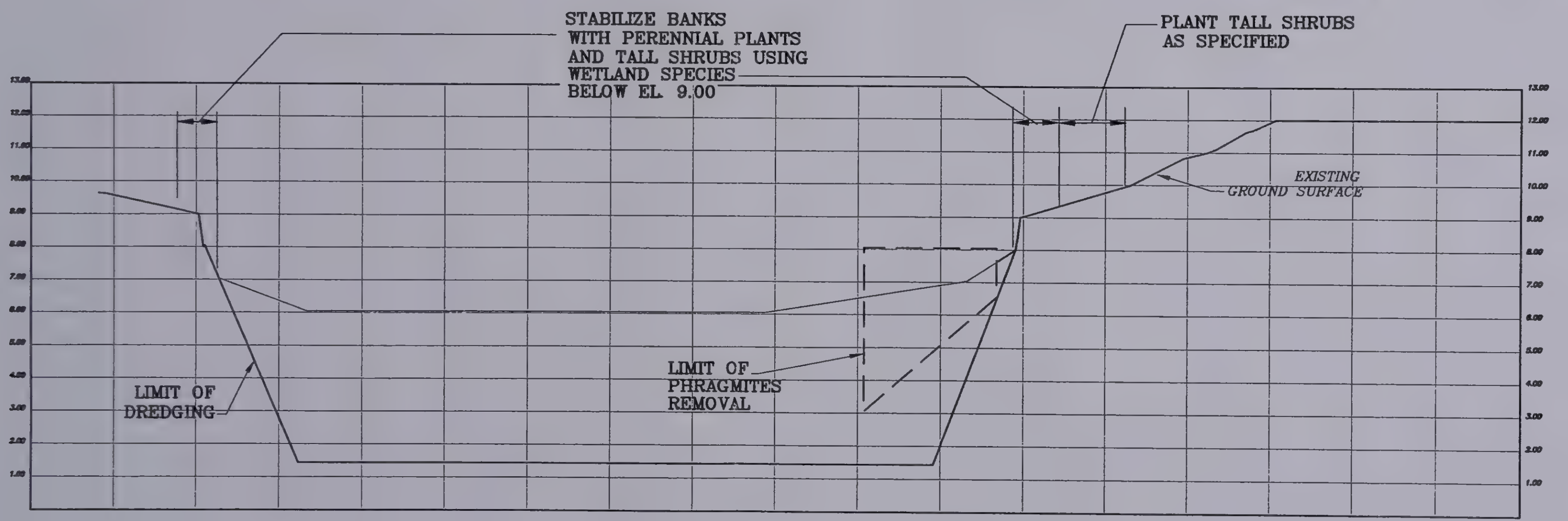
CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

TYPICAL DETAIL

PROJECT NO.
FILE NAME.
SHEET NO.
35

PLAN



SECTION 8A -

1" = 40'

1" = 4'

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

CDM Camp Dresser & McKee Inc.

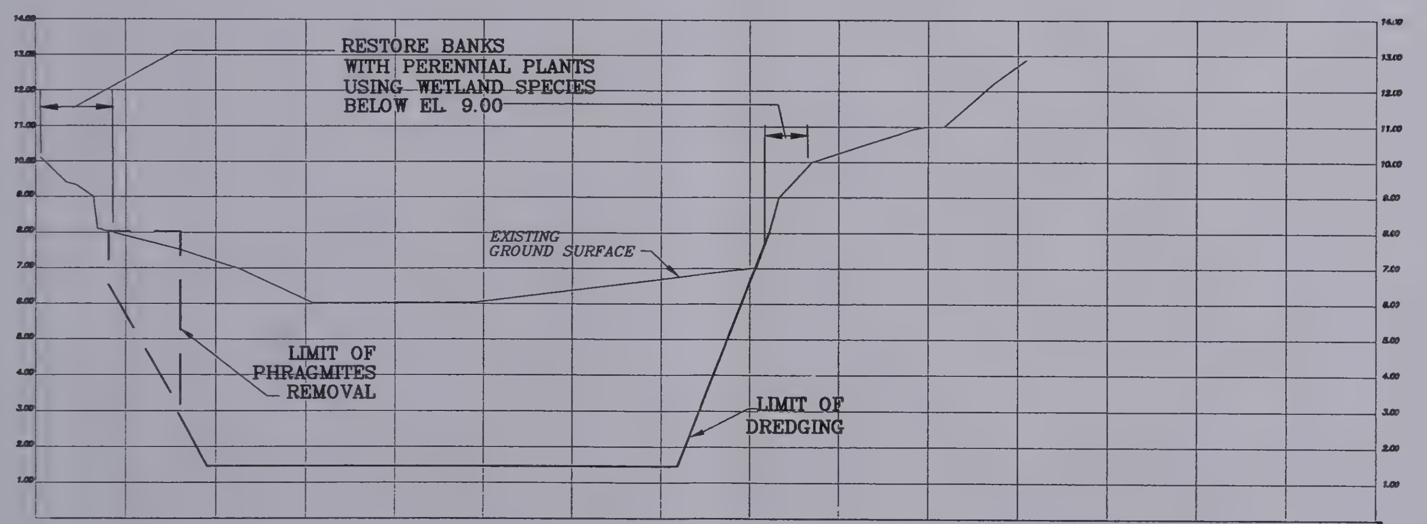
MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN AND SECTION

PROJECT NO.
FILE NAME:
SHEET NO.
36

R:\1517\28449\CIVIL\CPLSC8-A

PLAN



SECTION 8B -

1" = 40'
20 0 40
1" = 4'

REV NO	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

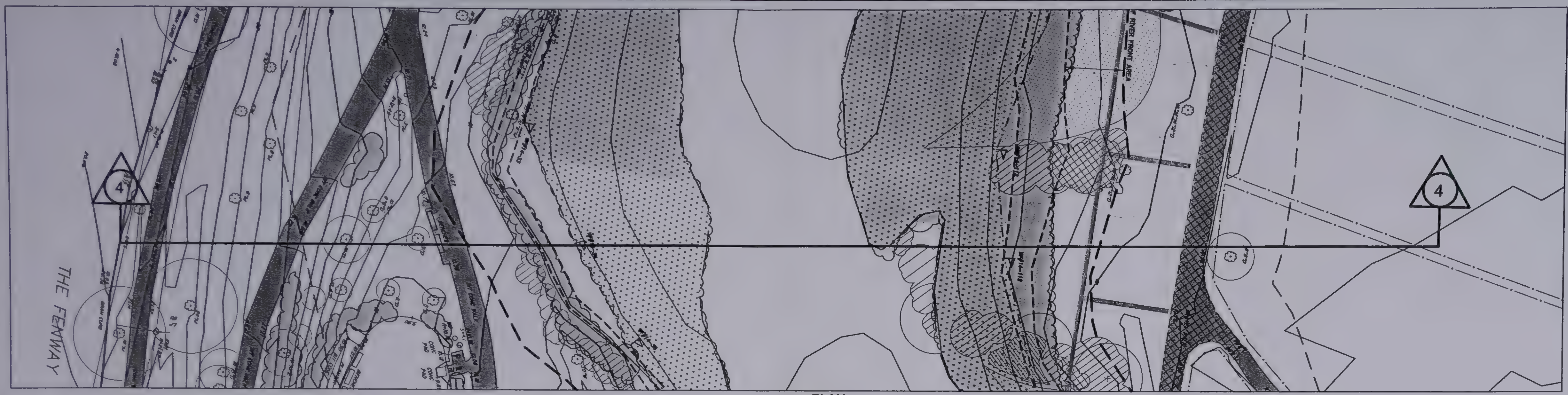
CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

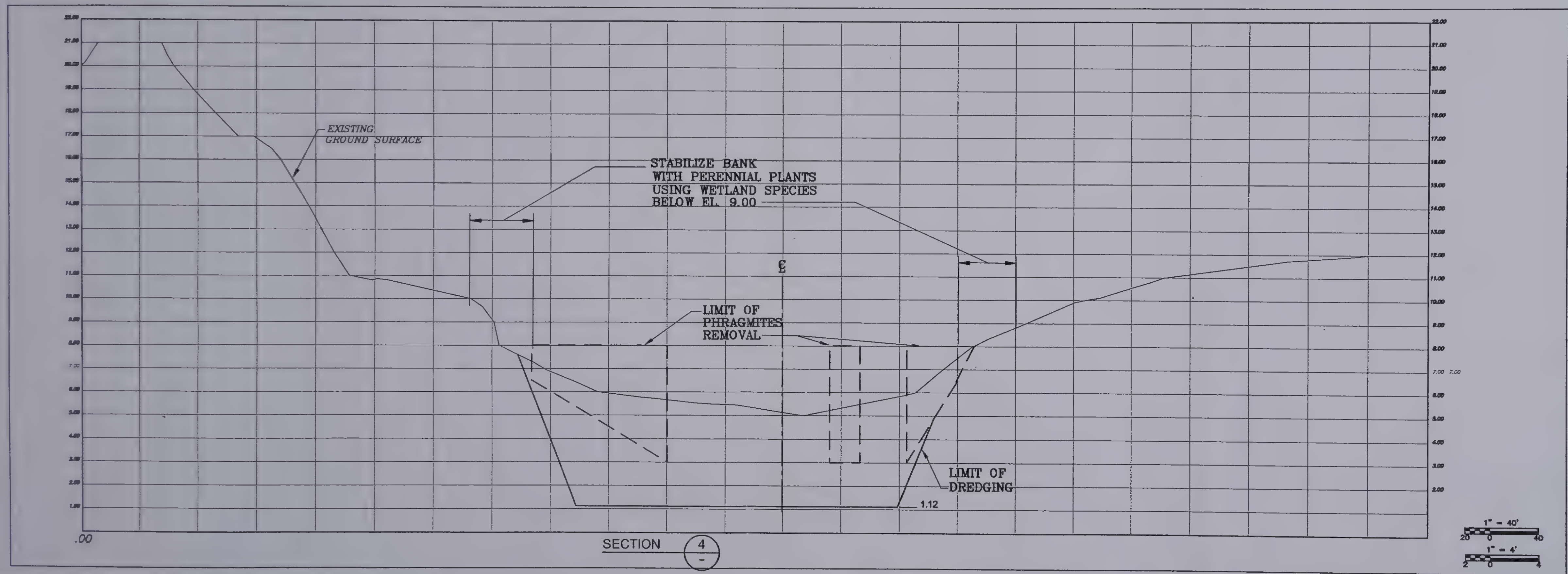
PLAN AND SECTION

PROJECT NO.
FILE NAME:
SHEET NO.
37

R:\1517\28449\CIVIL\CPLSC8-B



PLAN



SECTION 4

REV NO	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

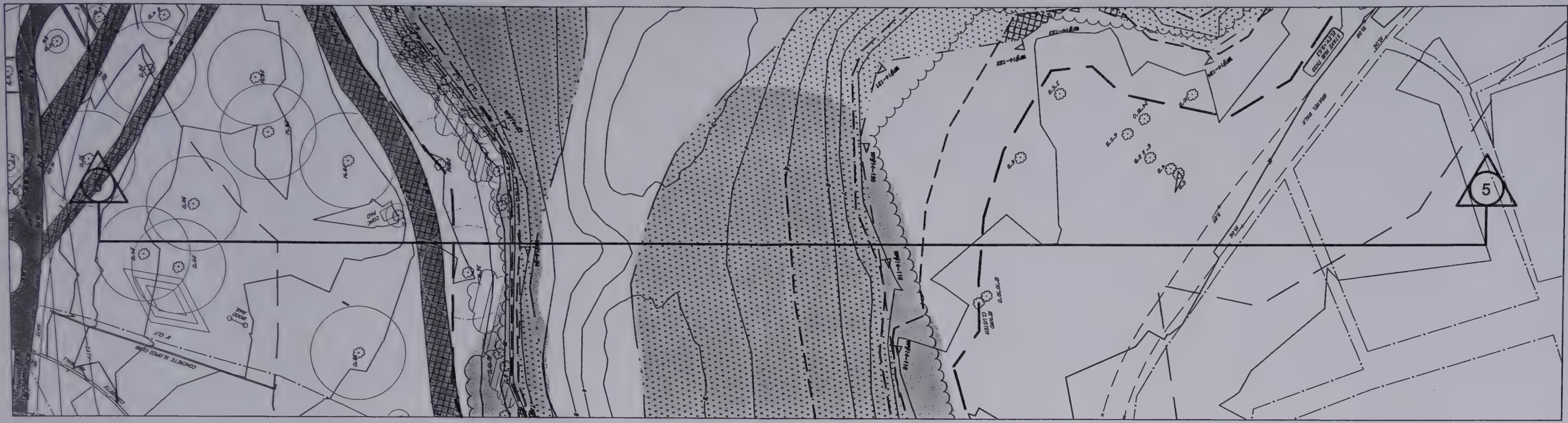
CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

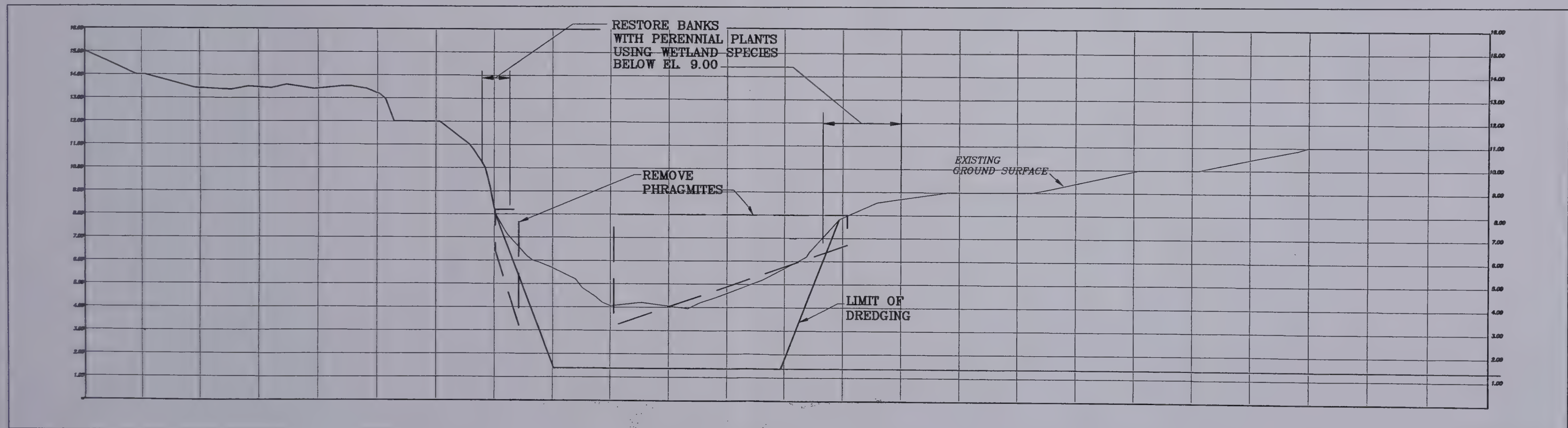
PLAN AND SECTION

PROJECT NO.
FILE NAME:
SHEET NO.
38

R:\1517\28445\CIVIL\CSPLSC04



PLAN



SECTION 5

1" = 40'

1" = 4'

REV NO	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

CDM Camp Dresser & McKee Inc.

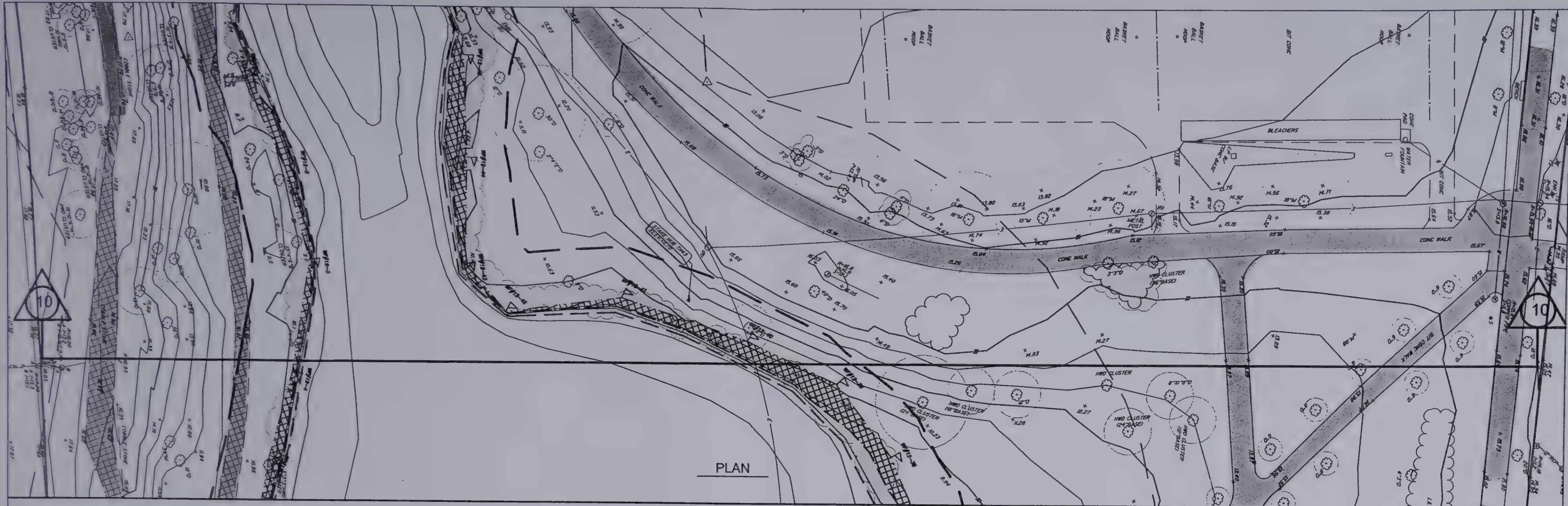
MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN AND SECTION

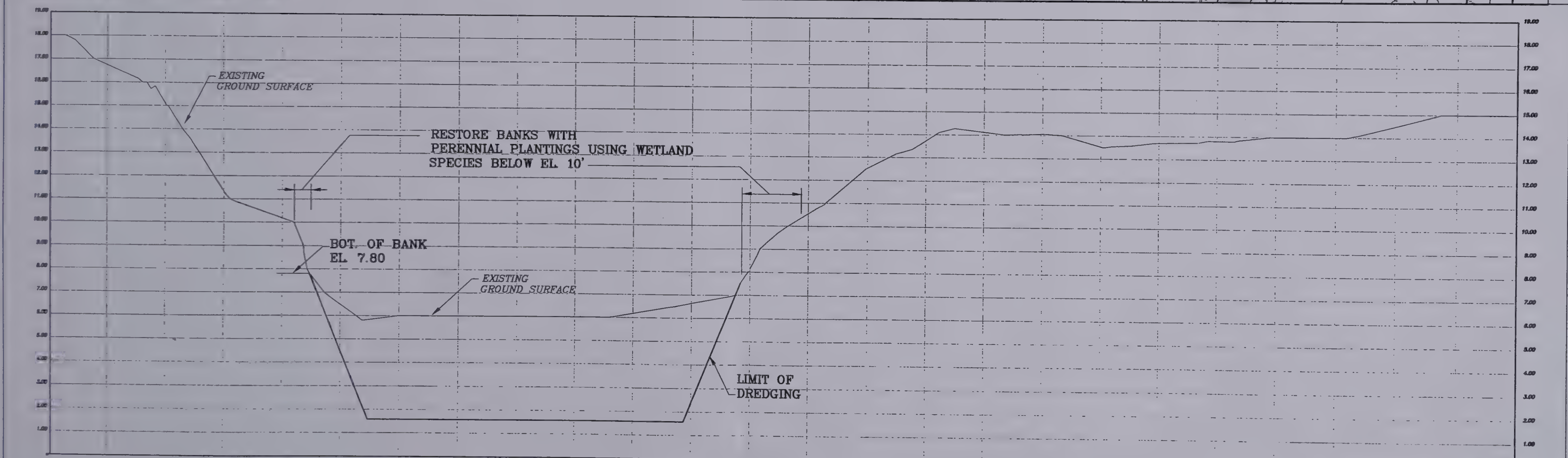
PROJECT NO.
FILE NAME:
SHEET NO.
39

R:\1517\28449\CIVIL\CSTPL408

[BOSTON PARKS AND RECREATION DEPT - MUDDY RIVER IMPROVEMENTS]
Filename: R:\1517\28449\CIVIL\CSCPL010.DWG Xref's: [BANK, WETLAND, ADD-ON, SVWET, BASE2,] Plotted by: TOUAYLM Time: 1/23/2003 3:41:46 PM



PLAN



SECTION 10

1" = 40'
20 0 40
1" = 4'
2 0 4

REV NO	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

CDM Camp Dresser & McKee Inc.

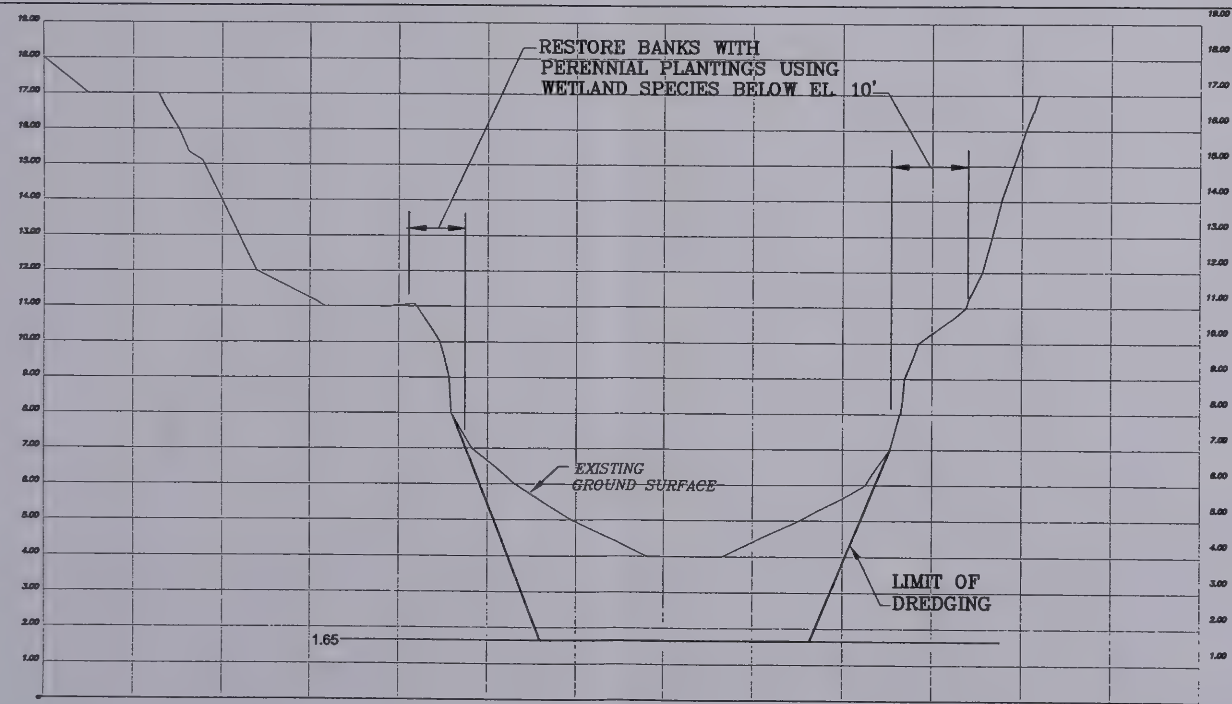
MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN AND SECTION

PROJECT NO:
FILE NAME:
SHEET NO.
40

R:\1517\28449\CIVIL\CSCPL010

PLAN



SECTION 11

1" = 40'

1" = 4'

REV NO	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

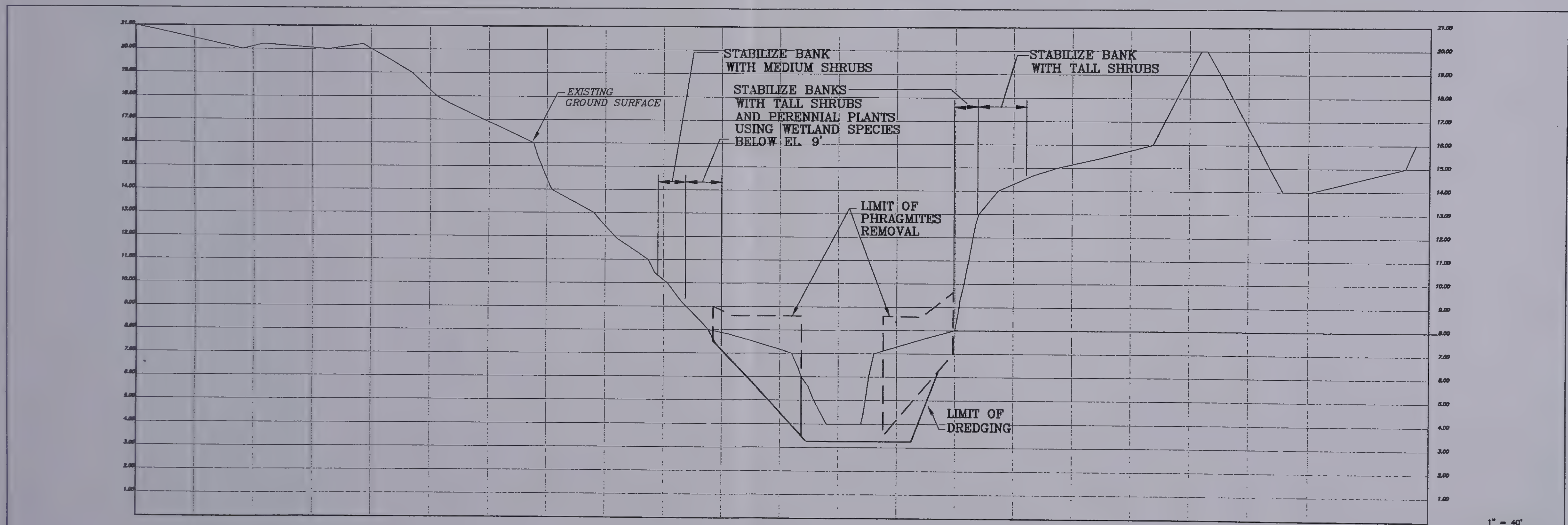
PLAN AND SECTION

PROJECT NO.
FILE NAME:

SHEET NO.
41

R:\1517\28449\CIVIL\CSCPL011.dwg

PLAN



SECTION 16 / -

1" = 40'

1" = 4'

REV NO	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

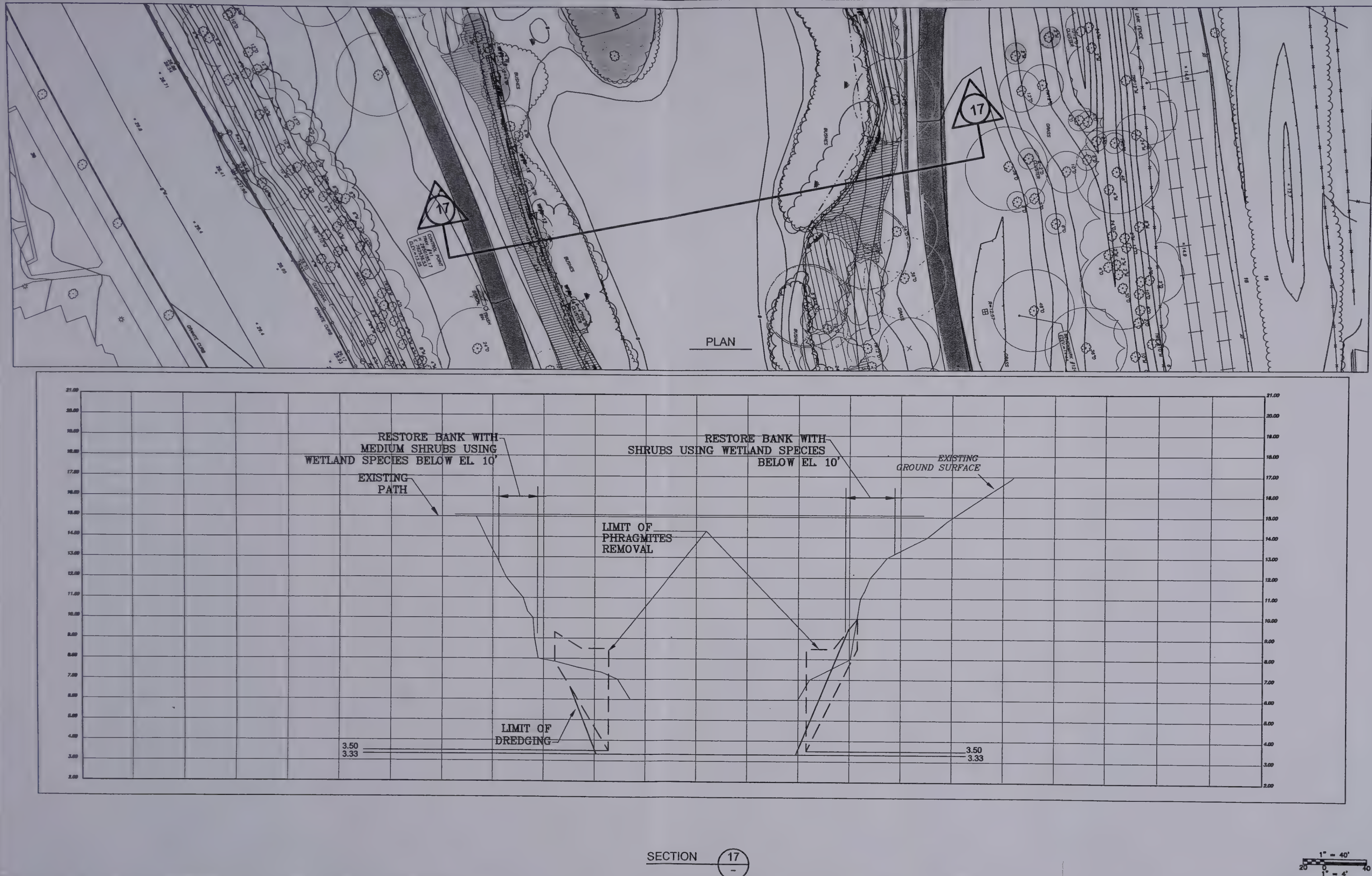
CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN AND SECTION

PROJECT NO.
FILE NAME:
SHEET NO.
42

R:\1517\28449\CIVIL\CSCPL016.dwg



REV NO	DATE	DRWN	CHKD	REMARKS

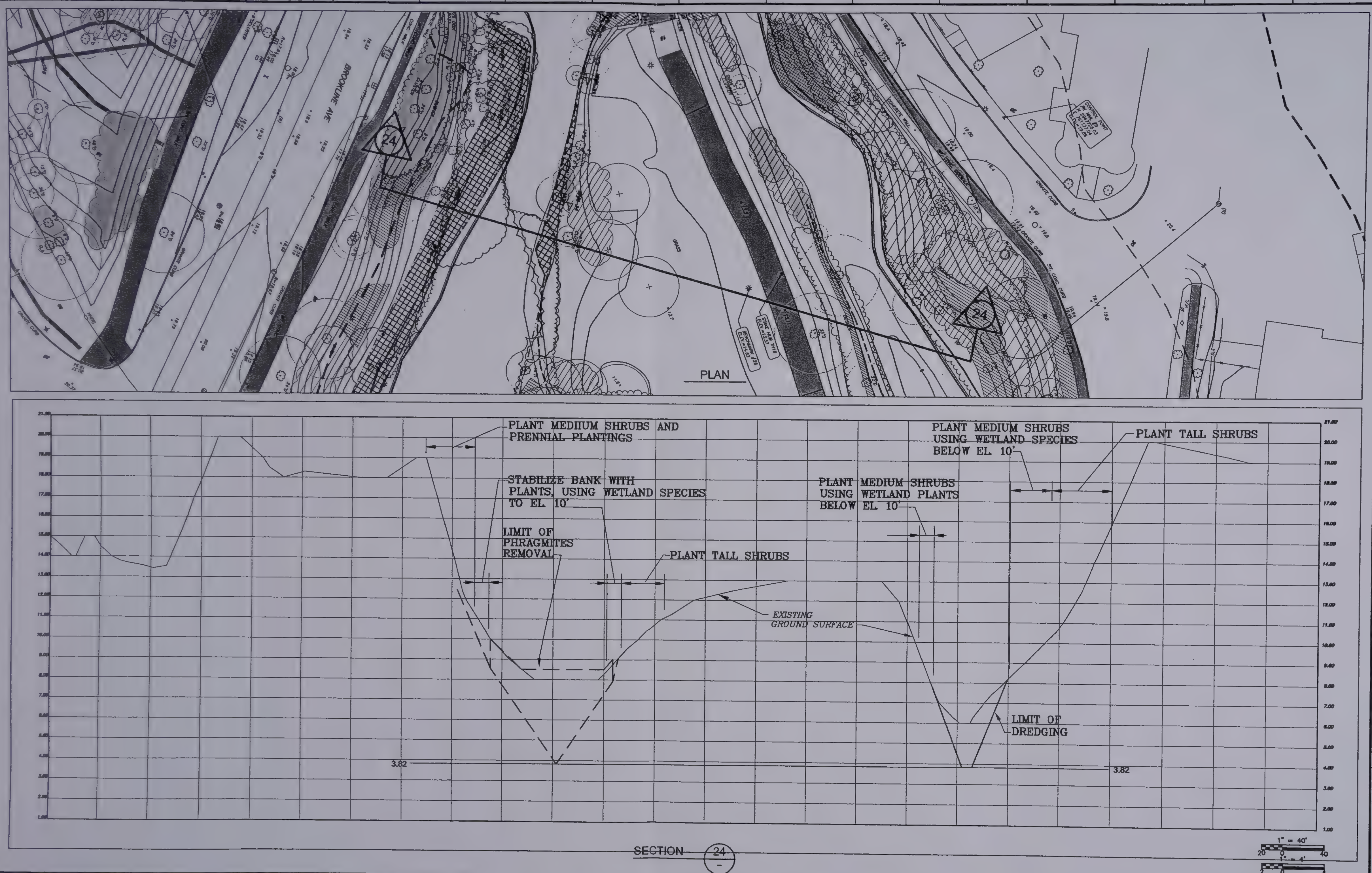
DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN AND SECTION

PROJECT NO.
FILE NAME:
SHEET NO. 43



REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

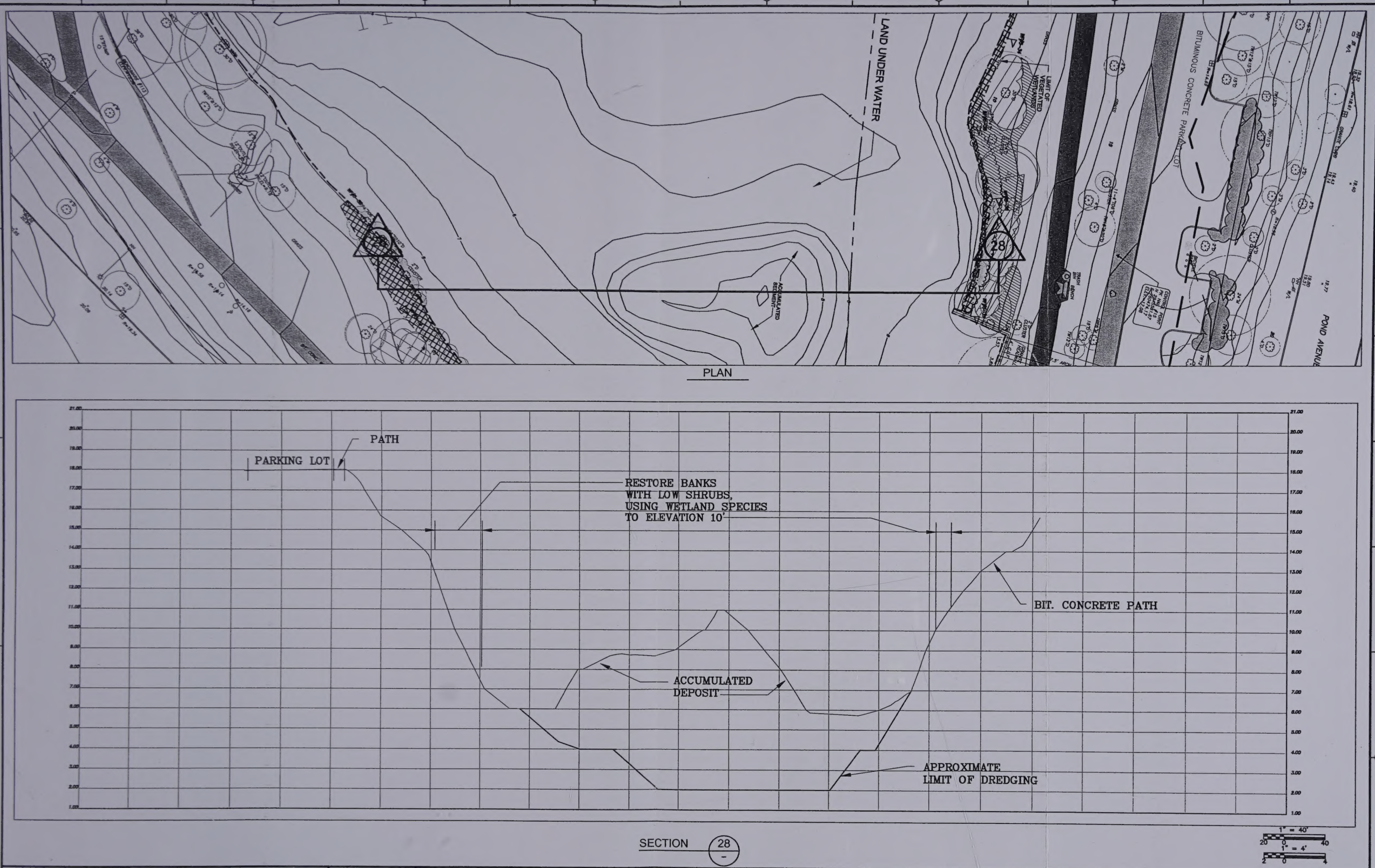
CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN AND SECTION

PROJECT NO.
FILE NAME:
SHEET NO.
44

R:\1517\28449\CIVIL\CSCPL024.dwg



1" = 40'
1" = 4'

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. DUNK
DRAWN BY: M. TOUAYL
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: JANUARY 2003

CDM Camp Dresser & McKee Inc.

MUDDY RIVER RESTORATION PROJECT
IMPACTS AND MITIGATION

PLAN AND SECTION

PROJECT NO.
FILE NAME:
SHEET NO. 45

R:\1517\28449\CIVIL\CSCPL028